RAILROAD GAZETTE

FRIDAY, JUNE 26.

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Contributions.

Malleable Iron in Car Construction.

CAPE MAY, June 15, 1891.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I have read with much interest the editorial note in the *Railroad Gazette* of June 12, on the astounding statement by a car journal regarding the use of malleable iron in car construction. The fallacy of the statement which you criticise is apparent to all, but I would like to attest to the fact that malleable iron *is* a recognized factor in car construction. It surely must be, as nearly all specifications for standard freight cars of a majority of railroads in this country contain numerous requisitions for that material. The oldest and best equipped roads make the most calls for this class of material.

If in any quarter there is a mistrust of malleable iron, it must be because there has been a poor quality of that material used or made by those who have no pride in their output. Perhaps this poor class of material has been put out because the manufacturer desired to meet the low price at which it has been reported that malleable iron could be purchased. All reputable manufacturers assert that a first-class grade of malleable iron cannot be produced at such low prices with any profit left to the manufacturer. The scrap pile tells the story. Among the largest users are the vertical-plane coupler companies, who are well aware that the majority of breakages which injure the reputation of their couplers arise from a poor quality of iron, and even those breakages are small compared to the breakages of knuckles that are made of cast steel.

Before the days of vertical-plane couplers some of the railroads used link drawheads made of malleable iron, and the percentage of broken ones was so small that no record was kept after the first year's experience, clearly demonstrating that if good material is used malleable iron holds a place in car construction that cannot be filled by any other material at the same price.

GEORGE W. MCGUIRE.

The Reno Tunnel System.

TO THE EDITOR OF THE RAILROAD GAZETTE:

I noticed in the last issue of the *Gazette* some comments made by "Slow and Sure" on the Reno Tunnel System, of which a description recently appeared in your columns, and as the person above mentioned is in error concerning two or three points, I would like to call his attention to the fact.

He makes a statement that the Reno Tunnel "is entirely without bracing." If he will re-read my article he will note that I mention therein in three different paragraphs, the system of horizontal and vertical bracing. This is an essential feature of the tunnel and should not be overlooked.

"Slow and Sure" mentions the tendency of the circular tunnel shield to turn upon its axis, which I think can be explained in this way: If a cane is pushed into moist earth its progress is greatly assisted by twisting it. Likewise, if the armature of a large dynamo is set in motion, a slight pressure against the end of the shaft will move it along its axis, while it would take a force of many pounds to do so were the shaft not revolving. The principle of both of these phenomena is the same, and, in the writer's opinion, the cause of the diminished friction is due to a ball-bearing effect attained in the one case by particles of earth rolling about the twisting cane, and in the other by the particles of oil revolving around the armature shaft. The converse of this should also be true, viz., when the circular tunnel shield is forced ahead it naturally takes the path offering the least resistance, thus giving the slight axial twist to the shield mentioned by "Slow and Sure." However, there could be no tendency to this twisting in the rectangular shield, for the simple reason that its shape precludes such a possibility, and it is very thoroughly braced, as I have shown.

The prophecy made by "Slow and Sure" that the Reno Tunnel "could not possibly stand without foundations" will be interesting matter to engineers, and to the stockholders of the various tunnels that have been driven in soft materials during the last 50 years.

J. W. RENO.

A Chance in Nova Scotia.

YARMOUTH, N. S., June 16.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The "missing link," as the new bit of road between Digby and Annapolis is called, will be formally opened for business by the Windsor & Annapolis Railroad about the last of this month, and afford through railroad service between this port and the southwestern end of the Province and St. John and Halifax. The completion of this 20 miles of road and the recent establishment of a direct steamship line to New York are expected to give an impetus to the commerce of this region, which has heretofore suffered for lack of transportation facilities.

At the same time interest has been revived in a project which has often been discussed among the business men of the Province. This is the construction of a railroad from this port along the southern shore of the Province to Shelburne, about 67 miles distant.

The scheme attracted the attention of the Dominion Government at one time and an official survey of the route was made. The Dominion Government will grant a subsidy of $3,200 per mile toward the undertaking, and the Province of Nova Scotia as much more, while the townships along the route will furnish the right of way, with gravel for ballast and timber for ties, free of charge.

The country through which this road will pass contains a population of about 30,000 souls, chiefly engaged in the fisheries, which are probably as extensive here as in any part of the country. Besides fish this region also produces large quantities of lumber, potatoes, blueberries and other articles of export, whose natural market is the United States.

At present connection is made with Shelburne by several stage lines, and two steamboats available chiefly for passenger traffic. There is a strong and growing demand for the proposed route, and the hope is generally expressed that some American railroad men of capital and experience may interest themselves in the project.

J. L. F.

Starting Gears for Compound Locomotives.

BOSTON, Mass., June 17, 1891.

TO THE EDITOR OF THE RAILROAD GAZETTE:

The letter of "A Friend of the Compound," in the *Railroad Gazette* of May 15, was very welcome to me, for I had in view in my letter the awakening of an interest in the important points that the "Friend" discusses. He was not slow in seeing the vulnerable point of my letter, to which I was not blind myself, viz., that the intercepting valve is in a state of development as well as the Lindner starting valve. Nevertheless, there is an important difference between the two. The Lindner device confessedly and purposely has holes in the high-pressure slide valve which are of use only when the engine starts, and which at all other times are a source of waste, because they allow live steam to pass into the receiver, and which steam therefore acts expansively only in the low-pressure cylinder. One purpose of my letter was to express disapproval of any device which thus or otherwise degrades the compound locomotive. A compound locomotive should not be an engine which merely uses steam successively in several cylinders. It should be a high-class and economical machine. It should be as simple as possible; should have as few cylinders as possible; should have a minimum of condensing surface and a maximum of reheating surface. It should not be incumbered with a starting device which persists in working to any extent after the starting is over. The intercepting valve has for its function the prevention of the flow of receiver steam back to the high-pressure piston when the engine starts; and after the engine has started the intercepting valve should be entirely inoperative.

I think it is a mistake to suppose that two-cylinder compound locomotives do not require intercepting valves. As for me, I do not care to prove that they do. I am willing to accept the statements of persons who have tried them without intercepting valves and have been forced to use such valves. Mr. von Borries is one of them and Mr. Worsdell another, and these two men have probably had more experience than all others combined. In the discussion on Worthington's paper on the compound locomotive, Mr. Worsdell said: "Of course I fell very naturally into the idea that a locomotive engine could be started as easily as an ordinary mill engine or a compound marine engine; but I found that the circumstances were adverse to starting with a fully loaded train, especially at the foot of a gradient, with the ordinary injection steam valve into the low-pressure cylinder. The reason was that the steam entering the chest of the low-pressure cylinder immediately traveled round and got into the exhaust side of the high-pressure cylinder, and blocked the piston. In certain positions of the valve, perhaps once in ten times, the engine would fail to start; and I set to work to devise some means by which the difficulty could be obviated. The result was the intercepting valve, a means of closing the exhaust between the high and low-pressure cylinders, so enabling the full power to be got from the steam that was admitted into the low-pressure cylinder without entering the high-pressure cylinder." This must be regarded as authoritative. Now, if a compound locomotive without an intercepting valve ever refuses to start, it is useless, and nobody wants it. I understand that with intercepting valves they never refuse to start. Our "Friend" seems to think that if the engineer is intelligent and knows the positions of the cranks, he can start the engine without an intercepting valve. Suppose that under those conditions he went through the proper manipulation, and the engine refused to start. I fear his knowledge would require the assistance of the pinch bar. Or in a dark night, must he get off and see where the cranks are every time he stops?

As to the leakage of intercepting valves, it can be in several ways. Steam, when the intercepting valve is closed, as in starting, may (*a*) leak from the low-pressure chest into the high-pressure exhaust cavity and retard the high-pressure piston; (*b*) live steam may leak through the intercepting valve into the low-pressure steam chest; (*c*) receiver steam may leak into the atmosphere, or (*d*) live steam may leak into the atmosphere. I believe that all of these can be entirely prevented by a good design, and (*a*) can only exist when the engine makes its first half revolution. An intercepting valve should be so designed that (*c*) and (*d*) show themselves to the engineer, and thus make themselves tell-tales of defects. (*a*) and (*b*), like the steam that passes the auxiliary ports of the Lindner valve are utilized in the low-pressure cylinder; and it is difficult for me to believe that (*a*) can be great if the intercepting valve is a simple homogeneous disc as used by von Borries and others.

F. W. DEAN.

Purifying Feed Water.

CHICAGO, June 20, 1891.

TO THE EDITOR OF THE RAILROAD GAZETTE:

SIR: In reading the report of the Master Mechanics' late convention, I have been surprised at the small progress which has been made in the purification of feed water, so far as shown by the information brought out at this convention, although, probably, more can be effected in saving of fuel by this means than can be by compounding of locomotive cylinders; certainly, if the saving of repairs be also taken into account.

The most common substance which forms the scale in the locomotive boiler is lime in solution, and it is well known to be instantly precipitated in still water by the addition of more lime. When all has fallen to the bottom of the tank, the purified water may be drawn off, and the lime in the bottom of the tank will be available for the purification of the next charge of water. By having several tanks, which can be alternately used for the precipitation of the lime and then drawn upon for the water supply, there is no labor necessary after the first charging of the tanks with a due proportion of lime, except the turning of the valves to change the flow into the empty tank, and to draw from the one which has completely settled.

Many years ago, I saw a plant upon these principles erected under the direction of Gordon H. Nott, C. E., at Adrian, Mich., which seemed to be very successful. Only two storage tanks were used, however, and the removal of the precipitated lime was sought to be in part accomplished by a rude sort of filtration, which was troublesome and cost something in labor for cleaning out; and it was evident that a better way would have been to use a greater number of tanks, or larger ones. But with this increased expense, the cost figured up only about one cent per thousand gallons treated, including interest on the cost of the plant and estimated depreciation. This experiment was on a practical scale, the tanks used being each of about 50,000 gallons capacity, equal to about two days' supply for the locomotives watering at that station in each tank; but two days is not a sufficient length of time to admit of the total subsidence of the very fine precipitate through so deep a tank as those in use there, which were about 15 or 16 ft. high. Evidently, broad, shallow reservoirs would be the best for this mode of treatment.

I made a comparative analysis of this water, which was very hard before treatment, and found that something more than 90 per cent. of the lime was removed by the method of precipitation employed. Of course there can be no patent upon the method of purifying water, which has long been practiced in England, as well as on a small scale in this country, but I believe that some special form of apparatus for the convenient application of the principle has been patented. It ought, however, to be quite within the capacity of any engineer or master mechanic to construct an arrangement for this purpose which will be so elementary as to avoid any patents, and yet one which would be entirely efficient and satisfactory.

The same system is applicable to waters impregnated with other salts than those of lime; but in order to determine the proper substance to be used for precipitating them a chemical analysis will be necessary, while as to the lime a single experiment in the office with a tumbler and a pinch of lime thrown into the water will determine

something] although the well-known soap test is better. Or to precipitate the lime, if any, by the oxalate of ammonia, is a yet better method, because the quantity of lime contained by the water can, in this way, be accurately determined.

There is much waste of fuel incurred, in many parts of the country, simply from the use of muddy waters, for it is not usual for a settling basin or tank to be used, no matter how much sediment may be contained in the water pumped from a turbid stream. So far as I have observed, the master mechanic has nothing to do with designating the sources from which the water for the engines shall be supplied, but he must get along with such as has been provided for him by the department of the chief engineer, who, unless he is more than usually attentive to matters outside his department, will consider almost any water good enough for a locomotive if there is a sufficient quantity of it. I have known an engineer of reputation to arrange for the entire supply of water on his road to be drawn from wells in a region where every well yielded hard water, because this was cheaper in first cost than to secure purer water from running streams.

It occurs to me that it would be a judicious course for a master mechanic who is anxious to make a good showing for his department, as nearly all master mechanics are, to make a careful estimate of how much his expenses are increased in a year by the badness of the water he is compelled to use over what they would be if he had a fairly pure supply, and to submit this to the general superintendent or general manager of his road, in order that the said official may be informed of the facts. On most roads these facts, if known, would lead to an investigation as to what improvements can be effected, and to the adoption of means of purification such as I have suggested, and to changes in the sources from which the water is taken, and to the construction of settling basins to remove the mud, rather than to pump it into the boilers, as is now generally done.

ARCHIMEDES STEPHENSON WATT.

The Memphis Bridge.

One of the greatest bridges of the world, one that is remarkable not only for the length of its spans, but for the depth of its foundations, the originality of the methods used in sinking them, and for the simplicity and skill in its design, is the bridge over the Mississippi at Memphis. No bridge anywhere nearly as remarkable has ever been so quietly built. A few years ago the progress of such a work would have been watched with constant interest, if not anxiety, and it would have been closely chronicled in the papers. Now it is taken as a matter of course, and only a few engineers know that the piers are all completed and that the superstructure is now erecting. The shore arm of the eastern cantilever was erected before June 1, and much of the steel for the central span was on the ground.

In February, 1890, we gave a general description of this bridge, and shall repeat a few of the facts here. The bridge is building by the Kansas City & Memphis Railway & Bridge Co., and will serve the allied companies, the Kansas City, Fort Scott & Memphis and the Kansas City, Memphis & Birmingham, giving an unbroken rail line from Kansas City to Birmingham. It will also serve the St. Louis, Iron Mountain & Southern and the Little Rock & Memphis, as well as the roads which reach Memphis from the East, all of which now transfer cars by ferry. It is the only bridge across the Mississippi below St. Louis. It lies at the converging point of a number of railroads, and is on the line of great industrial and traffic development. It may reasonably be supposed, therefore, that it can earn enough to pay a fair interest on its cost.

The bridge proper consists of five spans, as follows:

	Feet.
Eastern shore span	225.83
Main span	790.42
Two river spans, each 621.06 ft	1,242.12
Western shore span	338.75
Total	2,597.12

The western approach will be a viaduct of 49 plate-girder spans on Z-iron columns, resting on small piers on pile foundations.

The bridge is of the cantilever type, as follows: Eastern shore span, cantilever arm, 225.83; main span, two cantilever arms, each 169.38 ft., and intermediate span, 451.66 ft.; one continuous truss span, 621.06 ft.; one span made up of a cantilever arm, 169.38 ft., and a span with parallel chord trusses, 451.66 ft. long, one end hung from the cantilever and one resting on a pier; one deck span, 338.75 ft. The trusses are spaced 30-ft. centres, but the portals will not admit of two tracks. The greatest height of trusses is 77 ft. 7 1/8 in. from centre to centre of pins.

There are but two bridges in the world with longer trussed spans than this, the Forth and the Sukkur bridges. The longest trussed spans now in existence or building are:

	Feet.
Forth, two spans, each	1,710
" " "	690
Lansdowne (Sukkur, India) one span	820
Memphis, one span	790.4
" two spans, each	621
Colorado River (Red Rock), one span	660

The superstructure of the Memphis bridge is entirely of steel except the nuts, swivels, clevises and wall pedestal plates. The pedestal plates are of cast iron and the other parts mentioned may be of wrought iron.

The river piers—five in number—are sunk to depths varying from 78 to 131 ft. below high water. They were all sunk by pneumatic caissons and are of masonry from the caissons to the bridge seats. The heights of the various caissons run from 40 to 80 ft. and of the masonry piers from 93 to 158 ft., as shown in the accompanying table. The masonry is of granite and limestone. The facing is of granite from Lithonia, Ga. The backing is of Bedford (Ind.) limestone. The backing is all of dimension stone, and altogether the masonry of these piers is probably as fine as any bridge masonry to be found.

DATA OF CAISSONS AND PIERS, MEMPHIS BRIDGE.

	Pier 1.	Pier 2.	Pier 3.	Pier 4.	Pier 5.
Began building	Dec. 21, '89	May 17, '89	July 30, '89	Nov. 24, '88	April 25, '90
Launched	Built in place.	July 29, '89	Oct. 26, '89	Dec. 15, '88	Built in place.
Placed at pier site	Dec. 21, '89	Sept. 23, '89	Oct. 28, '89	Dec. 17, '88	April 25, '90
Began filling with concrete	Jan. 1, '90	Sept. 25, '89	Nov. 5, '89	Dec. 23, '88	May 8, '90
Building completed	Mar. 8, '90	Oct. 24, '89	Dec. 11, '89	Jan. 10, '89	May 27, '90
Filling completed	Mar. 9, '90	Oct. 11, '89	Nov. 27, '89	Jan. 10, '89	May 30, '90
Sinking commenced	Jan. 10, '90	Oct. 10, '89	Dec. 16, '89	Dec. 27, '88	May 8, '90
Sinking completed	April 18, '90	Oct. 16, '90	Aug. 24, '90	Feb. 6, '89	June 8, '90
Sealing commenced	April 18, '90	Oct. 16, '90	Aug. 18, '90	Feb. 6, '89	June 8, '90
Sealing completed	April 22, '90	Oct. 24, '90	Sept. 4, '90	Feb. 10, '89	June 12, '90
Masonry commenced	Mar. 10, '90	Oct. 23, '89	Dec. 12, '89	Aug. 27, '89	No masonry Cyls. May 24, '90
Masonry completed	June 23, '90	April 25, '91	Jan. 24, '91	Sept. 3, '90	Set coping May 15, '91
Elevation cutting edge of caisson	137.85	88.09	85.39	122.94	124.93
Elevation top of caisson	190.69	147.29	125.01	173.38	204.98
Elevation top of masonry	283.17	283.17	283.17	283.17	241.91

Elevation high water, 216.2. Elevation low water, 181.6.

The foundations were put in by the Bridge Company under the immediate designs and superintendence of the Chief Engineer, Mr. George S. Morison, and the Resident Engineer, Mr. Alfred Noble. The deepest foundation is 130.8 ft. below high water, and the greatest depth below the water surface reached with this pier, during building was 108 ft. This, we believe, is the greatest depth at which the pneumatic process has ever been worked, except the eastern abutment of the Eads St. Louis bridge. This latter is 135.5 ft. below high water and the greatest immersion was 109.7 ft. In the Memphis bridge foundations, at the greatest immersion, the air pressure carried was 47 lbs. At this pressure the men worked in shifts of 40 minutes, each man working three shifts in the 24 hours. We give below a table of a few of the deepest foundations in the world. The "greatest immersion" is while work in the caissons was in progress.

Sunk by Open Dredging.

	Below L. W. Ft.	Below H. W. Ft.
Dufferin (Benares)	140.5	190
Hawkesbury	153	160
Poughkeepsie	132	135

Sunk by Pneumatic Caisson.

	Below L. W. Ft.	Below H. W. Ft.	Greatest Immersion. Ft.
Memphis	96.2	130.8	108
Eads, St. Louis	94	135.5	109.7

The reader will probably remember the description in our account published in February, 1890, of the use of mattresses in sinking the caissons. This device was, we believe, entirely new and original on this work. The bed of the river for a depth of from 40 to 50 ft. is coarse sand. In order to prevent scouring before the caissons could be grounded, the river bed under each caisson was carpeted with a mattress 240 × 400 ft. in dimensions. These mattresses were made of willows or other brush, woven together and bound by wire. These were anchored over the pier sites, loaded with stone and sunk. The caissons were then sunk on these mattresses, and, of course, the mattresses and loose stone were cut through to allow the caissons to sink to the clay. This expedient is said to have been very successful, as the caissons were sunk without any tilting out of level and with no trouble whatever from scour. On the mattresses which remain in position rip-rap is placed to prevent scour around the piers. The caissons rest on a very thick stratum of clay. It is the stratum which underlies Memphis and from below which the water supply of that city is taken by artesian wells.

The erection is being done by Messrs. Baird Brothers. On June 1 the eastern shore arm was up and the falsework was carried 169 ft. further into the river for the river arm of the same cantilever. This falsework stands about 90 ft. above the water. The members are handled in the usual method by hoisting engines, of which there are two in use, one with eight winding spools and one with six. They are the Mundy engines, which are familiar to those of our readers who are interested in work of this kind.

It is difficult to realize the immense proportions of the parts of the superstructure without seeing them. Drawings or figures convey but little idea. The main posts of the cantilever trusses are 80 ft. high and weigh about 28 tons. The main pin is 14 in. in diameter, of steel, and weighs 2,200 lbs. The steel pins at the panel points in the lower chords are 10 in. in diameter. For handling these immense masses no novel methods have been introduced; the erecting is simply a development of the methods long used by American bridge builders. The field riveting of the lower chords is done by pneumatic riveters designed by Mr. Morison.

This great bridge will probably be completed early in 1892. There remains now nothing difficult or problematical; all the uncertainties are past. The only delay now is in the delivery of the steel. The remarkable skill of the erectors, Baird Brothers, is well known and is a guarantee that there will be no delay in their part of the work.

Care and Maintenance of Electric Block Signals.*

BY G. L. LANG.

Automatic electric signals for keeping trains a certain distance apart, commonly called "block signals," are slowly but surely coming into use. The very able paper read by Mr. Stewart a year ago has placed before us various systems now in use. Other papers have called attention to the use and value of such signals, but no one has given us even a hint as to what was necessary to make these signals effective after they were once placed upon a railroad.

I find the usual condition to be something like this: Some smooth tongued representative of one of the various signal companies will secure an interview with the General Manager, usually selecting a time when the recollection of some accident is fresh in his mind, and show to him how by his system such an accident would be impossible. Cost of appliances and of erection are shown to be nothing compared to one first-class "tail ender." No argument is necessary to demonstate the value of such appliances, so the matter settles itself into a question of cost. Ordinarily not a word is said about the cost of maintenance, so the official gets the idea that once his road is equipped with signals the expense stops; that they will run themselves, so to speak, displaying automatically, and continuously, almost the intelligence of a human being. The signals are ordered, placed in position, and are found to work splendidly.

Soon engineers begin to report signals out of order; standing at "danger" improperly. Notice is probably sent to the Roadmaster, who knows no more about the signal than a child, except that it is "electric"; so he hunts up the telegraph lineman, who knows but little more. The result soon is that all the signals are at "danger" and the company that put them in is notified that the signals are a failure. Upon investigation the signal company usually finds the whole trouble to be simply want of care. Thus the signals have got a bad reputation through no fault of their own, while the General Manager discovers that the first cost is but the beginning of the expense.

What I am going to say may have a strong "chestnut" flavor to most of you, but knowing how many comparatively simple things I had to learn, or learn to apply, when I commenced the care of signals, I venture to mention a few of the points where trouble is apt to appear. As my experience has been mainly with a battery signal, what I say will refer to the systems using a battery more particularly.

First of all, select an intelligent man to take care of your signals, and impress upon him that eternal vigilance is the price of a perfect working signal. He should clean his battery zincs very often to keep the internal resistance at the minimum, the external resistance being merely nominal. A battery that will work a four-ohm sounder for two weeks will only work a signal circuit of half an ohm resistance one week. When the zinc becomes reduced one-half in size we do not notice it in a circuit of high resistance, but it is fatal to a circuit of very low resistance. In our service we have two circuits of different resistances; one from a half ohm to two ohms, the other from 10 to 20 ohms. We transfer the half consumed zincs from the low to the higher resistance circuits, keeping up the efficiency of both batteries. Fully nine-tenths of the failures recorded against block signals can be legitimately charged to the battery. This shows that this is the main point to watch.

Another point that if carefully and intelligently watched will save much anxiety and search for cause of trouble is the relay. Every relay should be hermetically sealed, so no dust can prevent the points from making sure and perfect connection. Every relay should be protected by a lightning arrester of some kind, as, strange as it may appear, relays in a circuit made up of the steel rails of the track and underground wires with no line wire whatever are often burned by lightning. Where the track is used as the circuit the joints are usually bridged by wires fastened to the rails by rivets driven into holes drilled for the purpose. These wires require very close watching, as the track workmen often break or loosen them. A detecting galvanometer is a valuable help in locating faults of this nature. In track-circuit systems insulations are necessary to divide the track into suitable signal sections, as well as for other purposes. These require great care in first introducing, as well as careful watching from day to day. The insulating material may be of wood, vulcanized fiber, leatheroid or other suitable material. . . . The cost per signal for maintenance of double-track block signals is not far from $40 per annum, varying somewhat according to the traffic. Notwithstanding the expense of installing a complete signal system and expense of care, I believe their use to be an economy when the traffic is as heavy as is the case on some parts of most of our leading railroads.

By the aid of these automatic signals trains are run into and out of our cities safely at intervals of one, two or three minutes, regardless of fog or weather. Without signals this could not be safely accomplished.

*A paper read at the tenth annual meeting of the Association of Railway Telegraph Superintendents, Cincinnati, O., June 18, 1891.

The Master Mechanics' Convention.

We conclude the report of the twenty-fourth annual convention of the Master Mechanics' Association. The topical discussion on compound locomotives and the report and discussion on testing laboratories appear elsewhere in this issue. The report on locomotives for heavy and fast service was published last week. The discussion was in part as follows:

LOCOMOTIVES FOR FAST AND HEAVY SERVICE.

Mr. BARNES: I would like to ask a question as to the meaning of the statement "With a 20-in. cylinder more

weight will be obtained on three pairs of drivers than can be utilized with a 60-in. wheel." I would like to know why such a condition is imposed—why is it that with a 20-in. cylinder more weight is obtained?

Mr. LEEDS: What we claim is that about 90,000 is all you can utilize with a 20 in. cylinder on a 60-in. wheel.

Mr. BARNES: That hardly explains why the weight is necessarily obtained with that cylinder.

There is a statement here regarding radius bars and swing links that should have attention. It is "truck hangers hung vertically would not be guided by pony at all, except the slight friction in displacement, and the drivers would do all the guiding." Now, the fact is that with vertical swing links there is a tendency to return to the centre immediately when the truck is displaced, and there is a decided guiding tendency when the hangers are hung vertically. When the hangers are hung outward and the centre bearing is wide and flat there is less guiding tendency at the start from the central position than when hung vertically, and there is more under the same condition when they are hung inclined inwardly at the bottom.

Mr. VAUCLAIN: I have taken the trouble to construct models and carefully weigh the lateral resistance of vertical swing links and those set in angle, and I will say that there is no appreciable difference except when you come to an extreme position. We have constructed probably 4,000 engine trucks with vertical swing links, and we have as yet to hear the first complaint.

Mr. AUSTIN: The fact of the matter is that it is not necessary to have the hangers on angles in order to get a certain resistance. If you make the links plumb, and make them as much shorter as the perpendicular distance, the resistance will be the same. One difference is that if you hang the links plumb and make them of a length suitable to get the required lateral resistance you guide your trucks without cocking the bolster and overloading either one side or the other. You will find if the links are drawn in at the top that as you pass around a curve the most of the weight will come on the outer wheel, and there are lots of trucks running today on which in rounding a curve the wheel on the inside rail will lift four inches off the track. Now, if you hang the links vertically you still keep the same weight on each journal without the distortion of the bolster.

Mr. LEEDS: I have found that by the angle of the links alone I could change the flange wear entirely. I can divide it between the truck and the forward driver with the same radius car.

Mr. LAUDER: Links hung vertically will usually allow the front-driver flange to chafe and become sharp. I have seen mogul engines put out new and in a month the front flanges on the drivers would show signs of chafing where the links on the truck were hung vertically. By simply changing them to an inclined position that chafing is removed. A great many may have noticed that truck flanges chafe and get sharp. I always like to see that, because I know the truck is doing its proper duty.

Now, with referance to the relative merits of the 10-wheel and mogul engine for passenger service, it is something a question of locality, largely a question of prejudice and very little a question of actual fact. They both do good work.

I don't agree with the committee in all their conclusions, especially with regard to the better distribution of the weight on the 10 wheeler. I think it is very much better on the mogul. In the first place, you don't have to carry so much unnecessary weight on your truck. I think most of us will feel we have got a total weight that is not excessive if it is properly distributed, and it is better to have a little surplus weight on our drivers for contingencies that may arise than haul from 14 to 16 tons' weight on the truck when 7 to 8 is all that is needed.

Nobody here will argue that the consolidation engine is unsafe or undesirable, and the consolidation engine is simply a mogul of a little larger growth, as the 10-wheel engine is the 8-wheel of a little larger growth. In both cases the construction of the engine is practically the same. Now, has anybody ever heard of the mogul or consolidation leaving the track by reason of any defect in the construction or principle? I never heard of such a case. So that the prejudice existing against the mogul should be done away with, because it has no force whatever.

Mr. WEST: I hope this Association will not go on record as advancing the idea that the mogul is unsafe. We are running mogul engines 55 miles an hour on one of the crookedest roads in the country, and we have never had a train leave the track on account of the truck.

MR. MEEHAN: I don't think it was the intention of the committee to convey the idea that a mogul was not safe for any service. On the system that I am connected with all the freight engines are moguls and consolidations. We considered that it was better to have a 10-wheeler where it was necessary to exceed 18 × 24 cylinder.

If we found it necessary to get large engines for passenger service we feel disposed to go to the 10-wheeler, believing that there was a greater factor of safety for a high rate of speed, not because we believe that the mogul is not safe. I prefer the mogul for the reason that we do the same work with a lighter engine. I have always considered for good freight service that the mogul or consolidation engine was as economical an engine as we could use.

Mr. SMART: There is safety in the four-wheel truck which is absent in the two-wheel truck. I have no hesitation whatever in running a mogul engine at 50 miles an hour in heavy passenger service when it becomes necessary in case of breakdown, and I have no fear of the result. I don't want to put myself on record as saying that the mogul engine is unsafe, but I believe the 10-wheel engine is preferable.

Mr. MEEHAN: We put three 10-wheel engines in service on the Cincinnati Southern Division. The two middle districts are very crooked and we found in the course of events that the blind front driver jumped the track. We found that there was a lateral motion between the hubs of the engine truck of the boxes of an inch and a quarter. We immediately took up this. But the second time it occurred. I then took the engine to the shop and changed the flange tires to the front. In the mean time the engines had rigid trucks, and I found that they run elegantly. We had another case similar to this on the Louisville Southern. There were two very heavy engines placed in service; we soon found they had flanges as thin as knifeblades; we changed the flange wheel to the front and our trouble ceased. Those engines also have rigid trucks. I haven't a particle of faith in a swing-motion truck for a 10-wheeler.

Mr. GIBBS: The question under discussion is on the relative merits of two classes of engines for freight and passenger service. The discussion has narrowed to the question of safety. There are other points to consider, such as the relative cost of maintenance. There are too many mogul engines running to raise any question of their safety for that service, but which engine can be kept in serviceable condition better and longer and easier and cheaper? From what has been brought out here to-day, and what we have seen in the papers for years past, the success of the mogul engine seems to depend upon several delicate adjustments in the truck, swing hangers and length of the radius bars. As far as I have seen, nobody has come to any uniform rule in those respects. We on our road have 10-wheelers exclusively for fast freight service, but coming into our roundhouse there are some moguls of another road. I watched those pretty carefully. They cut the truck wheels very badly. If those truck wheels run habitually with sharp flanges, which they appear to do, it is not very safe; and if that can be easily remedied why hasn't it been done? We know that there must be no question of the perfect guiding on entering curves. We know that the four-wheel truck will do it, and we are justified in thinking that a two-wheel truck with sharp flanges will not do it safely.

The Committee to whom was referred the subject of

ELECTRICAL APPLIANCES FOR RAILROAD USE

reported as follows:

We find so few railroads have as yet adopted any of the methods for lighting, signaling, welding and kindred uses of electricity or for utilizing it in connection with motive power, that no data of consequence and importance could be procured. We find that in the few attempts on some roads to utilize electricity for the purposes above mentioned are mainly of an experimental nature, and no satisfactory results have as yet been attained from which an intelligent and comprehensive report can be compiled. We find in addition to lighting and signaling that an attempt at traction increasing and braking is being made, but as yet the result would not warrant our embodying them in our report. Your committee therefore suggests that this subject be made one for future consideration, and are of the opinion that in order to get reliable data and the true status of the subject that a new committee be appointed, consisting of members of our Association who are connected with the roads now experimenting with or have already applied or used electricity for any of the purposes mentioned.

The President appointed the committee on subjects for the next annual meeting as follows: J. Davis Barnett, George Gibbs and William Smith.

The following officers were elected:

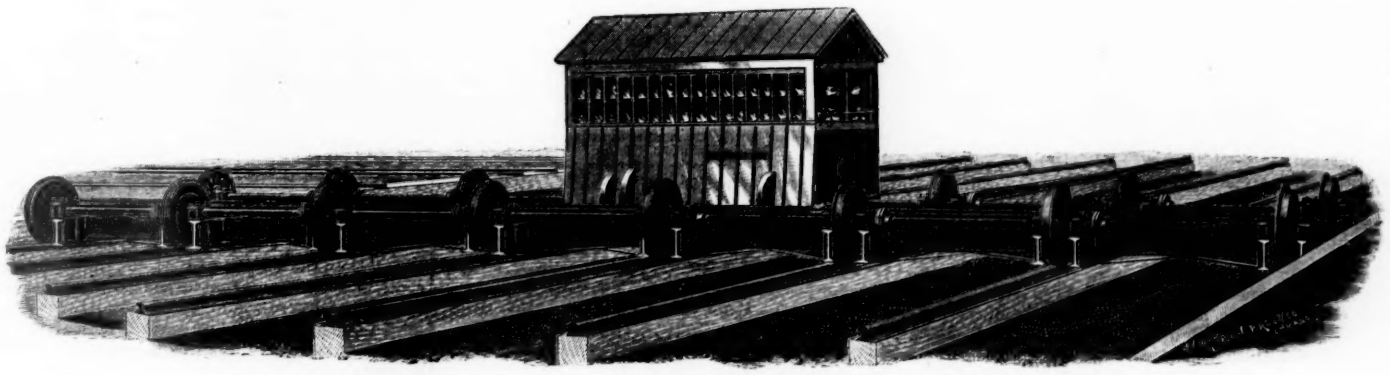
President, John Mackenzie.
First Vice-President, John Hickey.
Second Vice-President, William Garstang.
Treasurer, Orlando Stewart.
Secretary, Angus Sinclair.

Mr. SETTHELL: I move that the President of the Association invite the locomotive builders of the country who desire to do so to nominate one person to act on the Committee on Compound Locomotives, that person to be an active or associate member of this Association. Carried.

Electric Transfer Tables.

Electricity as a motive power for car and locomotive transfer tables has been in successful use for several years past. Until recently, however, the designs have been for machines of moderate capacity and length of table, intended for freight or passenger car work. The accompanying illustration shows one of three transfer tables recently constructed by the Industrial Works, of Bay City, Mich., having 225,000 lbs. capacity, for the Cheyenne and Denver shops of the Union Pacific.

These machines are equipped with a 15 H. P. motor, steel gearing, and framework entirely of iron and steel. The tables are 70 ft. long, and suited to locomotive or passenger car service. Their use during the last few months has demonstrated the efficiency and superiority of electricity as a motive power over the older form of propulsion. These tables were designed in the mechanical department of the Industrial Works, as were two others of similar capacity and design for the Chicago & North Western for the new Hudson shops, and two for the Union Pacific at Tacoma.



ELECTRIC TRANSFER TABLE OF 225,000 LBS. CAPACITY—UNION PACIFIC RAILWAY.

Built by the INDUSTRIAL WORKS, *Bay City, Michigan.*

Relative Value of Compound Locomotives of Different Types.

What follows is the substance of the topical discussion at the Master Mechanics' Convention on compound locomotives.

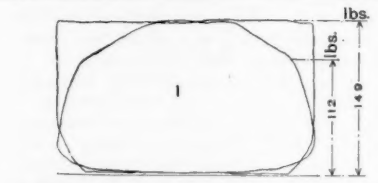
Mr. Vauclain (Baldwin Works) said: The time has come for taking up compound locomotives, but as we build so many different classifications of locomotives—over 600 different kinds and for 51 different gauges—it is a very important matter to decide just what type of compound we would take up to meet the demands of all customers. It is easy to compound small locomotives on almost any system, but large engines offer difficult problems. Mallet, with his two-cylinder system of compounding, has had to resort to the articulated system, or two compound systems in one, in order to compound large sizes, thus showing the limitations of the two-cylinder type. Mr. Worsdell and Mr. von Borries have succeeded in making a very good two-cylinder compound locomotive, but those that they have built do not equal the large engines built in the United States.

We found that it would be a wrong thing for us to undertake to compound all our locomotives in the two-cylinder manner. If cylinders 22 and 24 in. in diameter by 28 in. stroke were compounded in that way you would not have road width enough to put a low-pressure cylinder on one side of that engine. I don't think that anybody would want to use a 36 to 38 in. low-pressure cylinder for locomotives. We therefore thought that we would adopt a four-cylinder arrangement, and with that idea in view we brought out what is known as the Baldwin compound locomotive. We employ a high-pressure cylinder on each side. It has several advantages. We do away with the receiver; we have the improved expansion of steam from on cylinder to another; the cylinders are governed by one valve, and therefore we do away with starting gear entirely. We have another advantage, which everybody will admit; and that is if the locomotive on the road happens to break down on one side we can immediately tie up the one side and come in with the other side of the engine.

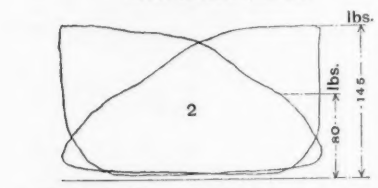
We have ample starting power. There is no difficulty whatever in starting a train; whereas with the two-cylinder type of compound there has been some difficulty in starting heavy loads and also starting on heavy grades.

I think it is the duty of this Association to appoint a committee of good men—men who are not committed to an opinion as to which is the better type, whether it is the two, three or four cylinder, or what it may be. We have, as you know, the two-cylinder compound running in the United States, also the Baldwin compound, the Johnstone compound running in Mexico, and one Webb three-cylinder engine.

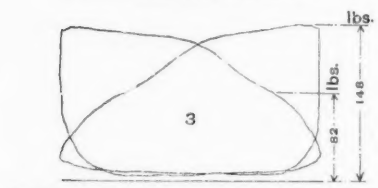
We have been very much handicapped in experimenting, from the fact that the majority of the compound locomotives we have turned out so far have been for foreign roads where the gauge has been different from ours. Recently we built two consolidation locomotives equal to the usual consolidation locomotives in use in this country, for a foreign order. It happened to be a 4 ft. 8½ in. gauge, and we tried it on the Lehigh Valley, on a grade of 100 ft. to the mile, having nine degrees reverse curves. The engine worked admirably. I have here blue prints of indicator diagrams that were taken at that time and during other trips made over the Reading and the Pennsylvania. There is almost an entire absence of back pressure in the low-pressure cylinder, and the drop in pressure from the high to the low pressure is very small, one upon the other. Compare these with cards taken from a standard engine. You



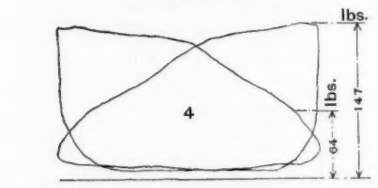
Throttle full open; 54 revolutions per minute; boiler pressure, 157 lbs.



Throttle half open; 72 revolutions per minute; boiler pressure, 161 lbs.

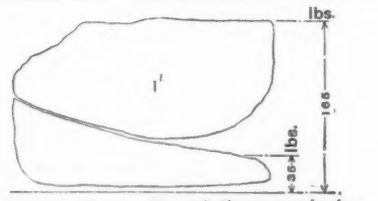


Throttle five-eighths open; 90 revolutions per minute; boiler pressure, 160 lbs.

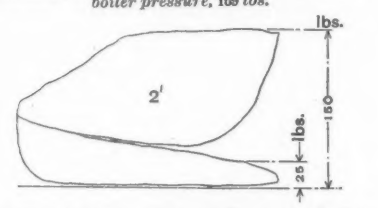


Throttle half open; 96 revolutions per minute; boiler pressure, 160 lbs.

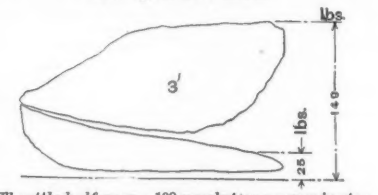
Standard Engine.



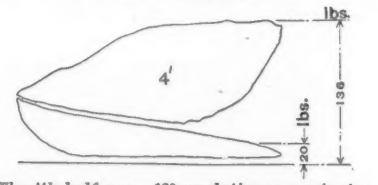
Throttle full open; 84 revolutions per minute; boiler pressure, 169 lbs.



Throttle full open; 100 revolutions per minute; boiler pressure, 159 lbs.



Throttle half open; 108 revolutions per minute; boiler pressure, 160 lbs.



Throttle half open; 120 revolutions per minute; boiler pressure, 160 lbs.

Baldwin Compound.

INDICATOR DIAGRAMS, WITH MR. VAUCLAIN'S DISCUSSION OF THE COMPOUND LOCOMOTIVE.

will notice a difference in terminal pressure. In the ordinary locomotive steam enters the exhaust passage at a pressure of 112 lbs. while it is at 50 in the compound. From 112 to 50 represents a considerable saving. We have figured up the water rate. The standard engine varied from 26 lbs. up to 30, which is very good for an ordinary engine. For the compound we got from 17 up to 21.

The economy is apparent. If the exhaust is violent you draw much coal through the tubes, you are bothered with sparks, you have got to clean the extension front two or three times in a run of 100 miles. We ran for three weeks a compound locomotive without being required to clean it. Some of the railroads have spent a good deal of money to get rid of those sparks. We get rid of them by keeping them in the firebox and burning them up. That is an additional economy. We found in all our tests an economy of fuel much higher than the economy in water. When we took this engine on the Pennsylvania road we compared it with the standard class "R" engine. When coming from Harrisburg to Altoona we used with a full train 13,000 lbs. of coal. The locomotive which followed with five cars less in its train used 26,400 lbs. of coal.

We already have orders for 49. The orders are coming in very fast. They tax our ability to get them out, as our special machinery for quick work has not yet arrived.

Mr. BARNES: I would like to have Mr. Vauclain state what ratio of cylinder volumes he thinks is best for the compound locomotives, and state why it cannot be obtained on a two-cylinder compound.

Mr. VAUCLAIN: I do not think the best results could be obtained with less ratio than 1 to 3; sometimes we get a little below it. We would rather be above it. We do it to keep up a regularity of size; we don't wish to run into quarter inches. We increase our low-pressure cylinder diameter by inches and our high-pressure cylinders by half-inches. For a compound engine equal to a cylinder of 21 in. in diameter we used high-pressure cylinders of only 13½ in. in diameter. To enlarge for a ratio of 3 to 1 on a two-cylinder compound would require a cylinder 36½ in. diameter. Where are you going to put such a cylinder? What are you going to do with your truck frames?

That piston would be very heavy in order to stand the strain. If there is anything wrong with the reducing valve you are likely to get an excess of pressure on that piston. You are going to have it break. I have no doubt if you look into the history of two-cylinder compounds in this country and abroad you will find that they have had a great deal of trouble with broken pistons; it is to be expected.

To show the unadaptability of the two-cylinder compounds I have drawn a few sketches. In this the two-cylinder compound is down to the lowest possible limit, which is a ratio of $2\frac{1}{5}$ to 1. You will find on this diagram a standard engine, the two systems of the Baldwin compound, the Webb and the Johnstone system.

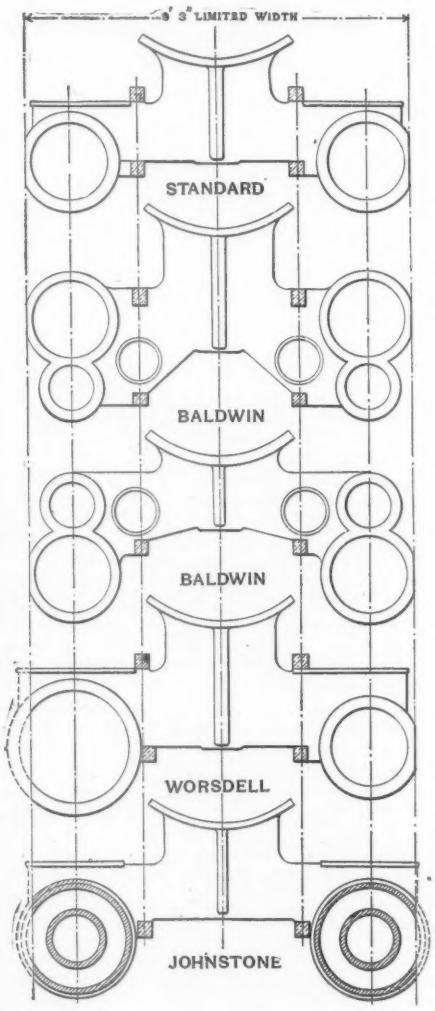


Diagram Showing Space Occupied by Compound Locomotive Cylinders.

The important question to be decided is which of all these is best, the four- or the two-cylinder compound, which system is most adaptable to all classes of locomotives? We have taken an order for five locomotives of 24-in. cylinders, 28 in. stroke, with boiler 76 in. in diameter. We are using every endeavor to have those engines compounded, as we realize how difficult it will be for any firm to get coal enough in that fire box when they are working that engine hard.

Mr. HICKEY: I would like to ask what serious objection Mr. Vauclain has to receivers in compound engines.

Mr. VAUCLAIN: Anything intervening between the two cylinders causes loss of power; anything that extracts heat from the steam. Anything that allows the steam to expand in space before it acts upon the piston detracts from the pressure of that steam, and consequently from its power. I don't think that the steam can be heated in passing through a receiver. I think if the diagrams from the two-cylinder compounds are thoroughly examined there will be found a very appreciable loss of power from one cylinder to the other. Our English friends have found that with the two-cylinder compound they must resort to wheels of large diameter. With the four-cylinder type the size of wheel makes no difference. We have had compound engines run as high as 1,480 ft. per minute, piston speed.

Mr. BARNES: There are two points we might hear something further on, I think. First as to the relative advantages of compounding freight engines and high-speed express engines, and second, I noticed that Mr. Vauclain has avoided all reference to the cylinder condensation, which is a mysterious element of the saving. What is his experience in regard to the relative saving by the reduction of cylinder condensation, and by better expansion?

Mr. VAUCLAIN: We think there is a great gain by reduction of cylinder condensation, and we offer this as a proof.

With the simple type of locomotive there is an indicated water rate of 25 lbs., and the actual is 33 per cent. higher, whereas in the compound, with a water rate of 17, our actual water consumption is only about 10 per cent. higher, which would give us a saving of 15 per cent. over and above the use of the ordinary type. This economy can arise from no other cause than reduction of cylinder condensation. Our high-pressure cylinder is always nearer the temperature of the steam that is admitted to it than the cylinder of an ordinary simple engine.

Mr. BARNES: I venture to say that on the cards shown here the water consumption as measured from the indicator cards is 50 per cent. less in the compound than the simple; add 50 to 15, that would be 65 per cent. It seems to me that all the saving of the compound shown heretofore would be accounted for by simple measurement of the indicator cards here given.

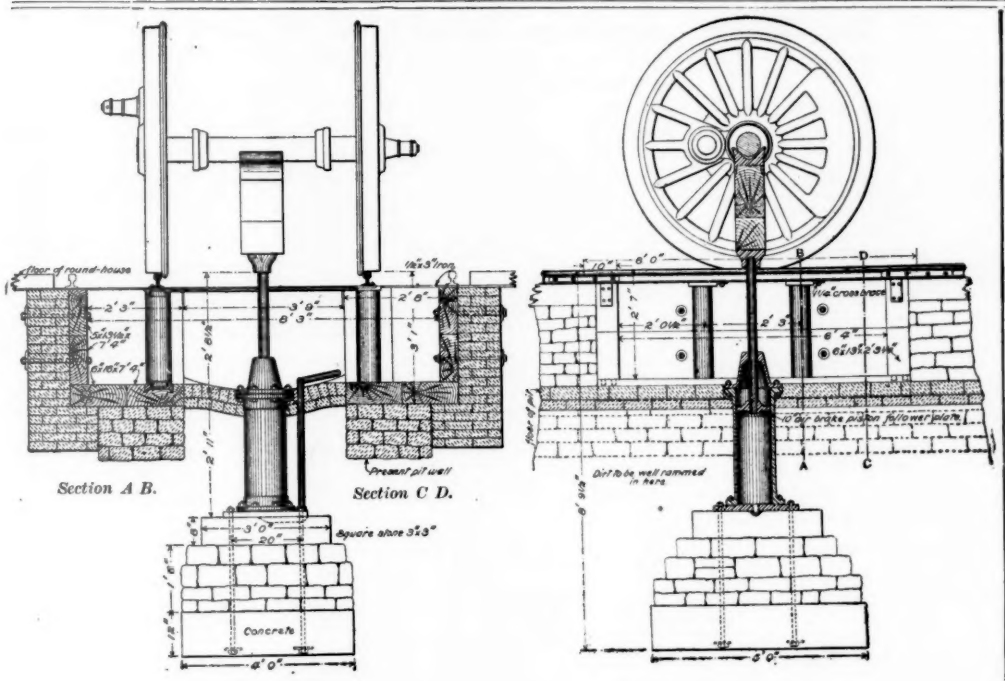
Mr. VAUCLAIN: I think that is correct. We have found by actual experiment that the greatest economy is to be looked for in freight service; that when you get up to high speed the economy decreases. The compound engine is at home on a grade with a dull, heavy drag. In experimenting with the Australian compound we found we used very little more coal on a grade than on a level. I could not account for it. When I figured up the water rate the matter was explained. If on a grade we required 25 per cent. more power to haul the train than on a level, and used but little more fuel to do it, we would certainly turn to the indicator diagrams to find out the cause. The actual cards on the grade showed a water rate of 17 lbs., while those on a level where the engine was cut back further ran up to 22 lbs., a loss probably of 25 per cent., and 25 per cent. more fuel on the grade simply made up for the difference in water rate.

Mr. A. M. WHITE (Schenectady Works): In continuing the discussion of the compound locomotive I feel called upon to defend the two-cylinder type. I will preface by giving a short account of what has been done by the Schenectady Locomotive Works. Our Superintendent, Mr. Pitkin, visited Europe some 18 months since to see for himself what they were actually doing. He found but very few compounds except the two-cylinder type, and he also found that the best ratio of expansion was from about two to two and a half, never over two and a half, which conclusion they had arrived at by practice.

The first engine we built was a 10-wheeler for passenger service, one of a lot of 11 then building for the Michigan Central. She was put in service some 18 months ago, and, with the exception of a few lost trips for some minor changes, she has been in hard service ever since on freight and passenger. This engine was accepted and paid for within 30 days of her delivery.

This proved so great a success that the railroad company ordered another of similar design which went into service nearly a year ago, and to-day is pulling the heaviest and fastest trains on the road successfully and economically, fully coming up to our expectations.

In July of last year we delivered to the East Tennessee, Virginia & Georgia two compound consolidations and one 10-wheeler for passenger service. The consolidations were 2 out of a lot of 18 similar in every way, except the compounding, while the 10-wheeler was like another simple engine built some time before. You can see that the above engines have had ample opportunity to be tested by actual service in competition with sister-engines not compounded, of same class and train service. Not expecting that this question of compounding would come up in the way it has, I regret exceedingly that I am not prepared to give indicator cards for your inspection, but the actual daily records of the above roads on their mileage sheets show more conclusively than any other



ROUNDHOUSE DROP PIT—BURLINGTON & MISSOURI RIVER.

way what they are doing, showing all the way from 17 to 30 per cent. of economy, which facts have come to us unsolicited.

The following information was given me last evening by Mr. J. B. Michel, Division Master Mechanic, East Tennessee, Virginia & Georgia: The percentage of saving in fuel for the past nine months on the 10-wheel compound over her mate, the 10-wheel simple engine, taken from the mileage coal and oil reports, was 22.55 per cent. On the consolidation for the past 11 months the fuel saving was 17.12 per cent. During the month of April just past, the saving in fuel on 10 wheeler was 23 per cent., while for the same month the consolidation showed a saving of 19.5 per cent. There has been no increase in the consumption of oil, but on the contrary there has been a saving of cylinder oil of 38 per cent. during the past six months. This is accounted for from the fact of the feed on the low side being reduced to nearly one-half of that of the high side.

We have also furnished the Southern Pacific a pair of compound cylinders which were put on one of a lot of ten, 20 in. × 26 in., 12-wheelers built about two years ago. The engine with the compound cylinders has been running in heavy service on the Pacific Slope, from which we have very flattering economical reports. We also compounded one of a lot of six 10-wheelers for the Atchison, Topeka & Santa Fe. We are now building another 10-wheel compound for the Southern Pacific and two 10-wheel passengers for the Adirondack & St. Lawrence.

One argument brought against the two-cylinder compound was the inability to come in on one side in case of a breakdown. I am surprised to learn that this matter has been given no more thought by those making the assertion. As a matter of fact, the 10-wheel compound on the East Tennessee, Virginia & Georgia became disabled on one side while about half way out on her trip; she took her train out and brought it back again with one side. The same thing has been done on the Michigan Central.

It is conceded by all that it is bad practice to jacket a live-steam cylinder with exhaust steam—please examine the cut on the cards placed in your seats yesterday, and notice that high-pressure steam must pass through a valve surrounded by the lowest of exhaust steam, the ports of which valve are necessarily small and divided by ribs.

Need I say anything about the unmechanical device of hitching two piston rods to one crosshead when the pressure upon them is unequal at times? Will the crosshead wear well? Need I say anything in regard to the complication and the care required for four pistons and rods when two should suffice? The assertion has been made that the pistons and rods would break on the large cylinders—this is only another misstatement. Also that the high piston speed attained by the use of small wheels for freight was very objectionable; this has not proved so. Objection was made to the receiver. Now, we consider this a good thing, and it is so considered by the most prominent mechanical engineers who have looked into the matter thoroughly.

The statement has been made that the four-cylinder type is necessary because there is not room on the railroad for the spread of cylinders required by the two-cylinder type. The absurdity of this statement may be better understood when we reflect that some of the largest compounds in use have inside cyliders. This is only a question of mechanical design, which we feel abundantly able to take care of.

Compound locomotives are progressing rapidly in favor and the simpler forms are certainly the most popular, and popularity is usually based on efficiency. A peculiarity about the three and four cylinder types is that none of the men having them in charge can be induced to talk favorably about them. The usual explanation of this is that railroad men are always prejudiced against improvements. Those who build the two-cylinder type find no trouble to get railroad men who use them to give expression of the faith that is within them.

Mr. VAUCLAIN: We do not say there is no economy in the two-cylinder compound. We know that there is. It has been proven abroad years ago, as far back as the original patent dates, but that economy is not sufficient, and for that reason we go to the four-cylinder compound.

The matter of surrounding a high-pressure steam with the exhaust steam has not been correctly stated. If you will refer to the cards we distributed you will find that the high-pressure steam comes into the ends of the valve, is admitted into the high-pressure cylinder, and is further conducted through the valve to the low-pressure cylinder. Therefore at a medium pressure, and at that only, does it pass to the exhaust steam. I would like to know what engine there is in use in which the live steam does not pass in close proximity to the exhaust, separated only by a narrow, thin strip of cast iron. Now, all these matters are simply matters of detail. They should be presented to the committee which we ask to have appointed.

As to the popularity of the types named. Altogether since the starting out of two-cylinder compounds there have been 750 built. We in not quite seven months have booked orders for 44 compound locomotives for all classes. This is a large percentage for the time and at the present rate we will, at the end of the present year, have built one-seventh of the total number that have been built in the entire world. For one road alone we have orders for 17 compound locomotives. The Schenectady Works in building a two-cylinder compound engine simply perpetuate what hundreds have done before, but use an intercepting valve that has been found to be inefficient and they are now offering another valve. The Rhode Island Locomotive Works have turned out a two cylinder compound, and a very good one. There is no reason why any works in the country should not turn out a two cylinder compound. I have pending in Washington now patents for two-cylinder compound locomotives. We will build any type of compound. We are not here to advance any peculiar type. We are builders of locomotives for anybody that wants them, of any kind. We are now building an engine of the Worsdell type to be run in competition with one of our engines in South America.

A Round-House Wheel Pit.

The wheel pit shown herewith is used at various round-houses along the line of the Burlington & Missouri River road, and from its construction permits the taking out of a set of driving boxes quickly. The foundation is of concrete and stone, with a brick back wall to which the 5-in. timber lining is bolted. The short movable rails are joined to the main rails by the ordinary splice bar, and rest each on two wrought iron pipe columns which sit over castings let into the bottom timbers. The rails are prevented from spreading by tie rods.

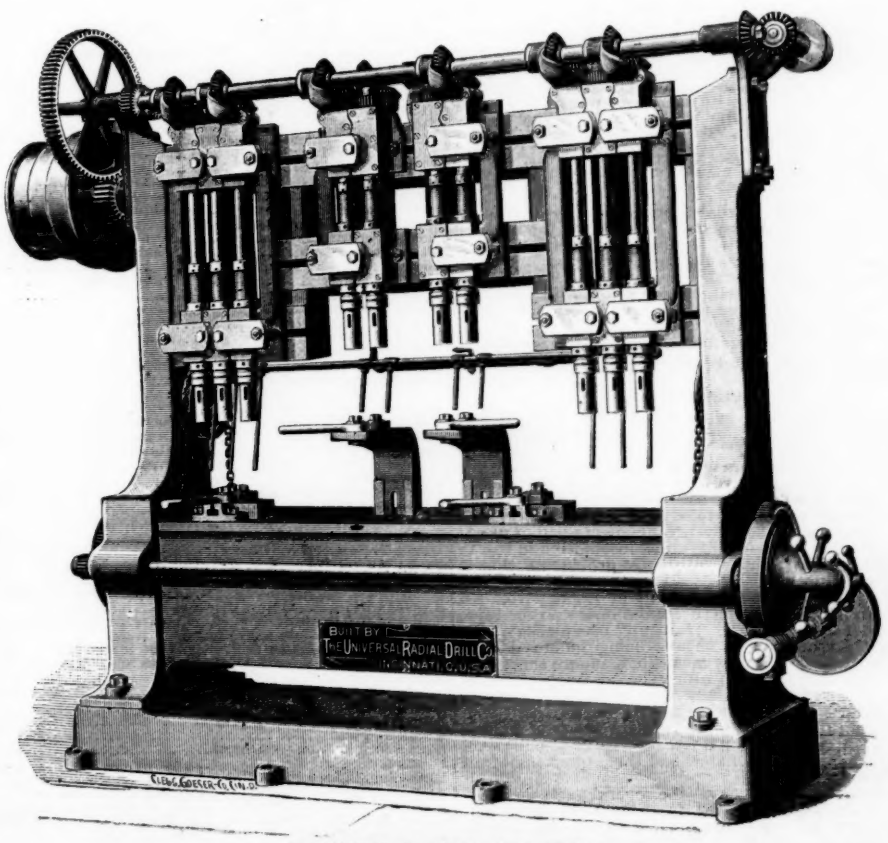
When the engine is in position for lowering a pair of wheels the V-block is raised up under the axle, sufficient packing blocks being placed above the cap on the piston rod, and the ram made to take the weight off from the rails, when the fishplates are removed and the rails taken out and placed to one side, the columns are lifted off the shoes and the pit is ready for lowering the wheels.

The floor of the pit may be of stone or brick, with sufficient dip to drain well at one end, and the supply pressure-pipe is carried from a convenient point to the lower end of the cylinder. The only change in the form of the usual pit is the tearing out of the side wall for about 8 ft., and the digging out sidewise of enough to leave 8 ft. 3 in. clear after lining in.

The cylinder is simply a cast-iron pipe, 2 ft. 8 in. long, flanged at both ends, having a 10-in. bore. The piston has an ordinary 10-in. air brake follower plate. The top and bottom heads are easily made, the pressure pipe being tapped into the latter. The whole rests on a 3-ft. square stone, fastened down with bolts set in the concrete.

A New Arch-Bar Drill.

The illustration of an arch-bar drill shows a 10-spindle machine, but it can be furnished with six or eight spindles. All spindles are driven simultaneously



TEN-SPINDLE ARCH BAR DRILL.

by a three-step cone carrying a 4-in. belt. The spindles have a lateral adjustment without disturbing the driving gears; they run in one direction, and can be closed up to drill to centres of 4 in. The spindle sleeves are threaded outside, and are adjustable vertically 4 in. by means of lock nuts, to compensate for differences in lengths of drills. The spindles are provided with vulcanized fiber thrust washers, and check nuts for taking up the wear of the collars.

The work table feeds upward by means of racks and pinions, belt driven, and has a quick return movement by hand and is also counterbalanced. The feeding table is provided with two saddle blocks, adjustable horizontally, also two supports, for the arches of car truck frames, and the latter are adjustable vertically to suit different heights. These saddles and supports have steel-faced back stops or jaws, adjustable to suit different widths of arch bars, and the clamping is done by the four levers shown, they being cam-shaped and revolving about s steel-bushed stud.

The cooling solution is piped to each spindle from one reservoir. The weight is about 11,000 lbs. This machine is made by the Universal Radial Drill Co., of Cincinnati, O.

New Railroad Mileage in the First Half of 1891.

The table of new track laid between Jan. 1 and July 1, 1891, published in this issue, may be regarded as fairly accurate. As it is published a few days before the close of the period to which the figures are brought, estimates have to be relied on in some cases, and in those instances minute exactness cannot be counted upon. There is no reason to doubt that the table is as accurate as those published in the last few years, which have been gratifyingly free from error.

The following is a summary by States:

Alabama	137	Pennsylvania	139.4
Arkansas	3	South Carolina	120.5
California	99.7	South Dakota	32
Colorado	10	Tennessee	45
Florida	7.5	Texas	23.1
Georgia	155	Utah	15
Illinois	15.7	Virginia	100
Indiana	5	Washington	102.7
Iowa	22	West Virginia	111
Kentucky	11.5	Wisconsin	18.5
Louisiana	36		
Maine	6	Total United States	1,609.7
Massachusetts	4		
Michigan	20.3	Alberta	70
Minnesota	16	British Columbia	60
Missouri	6	Manitoba	27
Montana	78.7	New Brunswick	6
Nebraska	12	Nova Scotia	5
New Hampshire	7.1	Ontario	14
New Jersey	33	Quebec	21
New Mexico	12	Mexico	305
New York	2		
North Carolina	84.4	Total Foreign	508
Ohio	102		
Oregon	16	Grand total	2,117.7

The Providence Meeting of the American Society of Mechanical Engineers.

The spring meeting of the American Society of Mechanical Engineers was held at Providence, R. I., June 16-19. There was a large attendance, and it was one of the most enjoyable meetings ever held by the Society. President Robert W. Hunt presided. Hon. Chas. S. Smith, the Mayor of Providence, welcomed the visitors, and traced the history of Providence through its manufacturing progress, and called special attention to its importance as an industrial centre. He said:

The state of Rhode Island has 140 cotton mills, employing 30,000 persons, with wages amounting to $10,000,000 per year. There is invested in these mills some $40,000,000 in capital, $14,000,000 work of raw material is used, and $30,000,000 worth of cotton goods are produced. The woolen mills are 85 in number, employing 20,000 hands, to whom are paid in wages over $8,000,000 per annum. These mills use up nearly $20 000,000 worth of raw material, producing over $35,000,000 in new goods. In this branch some $20,000,000 in money is invested. The city of Providence alone has over 200 jewelry establishments, employing over 6,000 hands, with an invested capital of over $15,000,000. Including all state and other industries there is a total investment of some $300,000,000. Providence has, within a radius of five miles, some 250,000 inhabitants, the number increasing quite rapidly.

In response to the cordial expressions of Mayor Smith, President Hunt spoke briefly. He recalled the name of Corliss as that of one who had been a leader in the profession of the mechanical engineer, respected and honored throughout the world. He associated with that of Corliss the name of Alexander L. Holley, who had "received the first grounding principles of mechanical execution under the eye of Mr. Corliss."

After the opening speeches the Society proceeded to business, taking up the paper of R. Van A. Norris, of Wilkesbarre, Pa., on

ROPE HAULAGE.

The author described two systems of rope haulage that have been constructed and put in operation during the last two years. The first problem to be met was the transportation of 600 cars up a grade varying from 1½ to 7 degs., and around a reverse curve for a distance of 600 ft., while the coal for the shaft and slope boilers, about 40 cars per day, had to be hauled from the breaker across these tracks, so that arrangements had of necessity to be made to allow the mine locomotive to run to the breaker on an empty track. To provide for this, it was decided to run an overhead rope at some 10 ft. elevation to allow a free movement of locomotive. An 18 × 48 in. plain slide valve engine operated the rope, with power to spare. The "take up" was placed at the driving end, the driving sheave being mounted on a truck, and being driven by means of a square shaft sliding in a cast iron sleeve to which the driving pinion was keyed. The end of the square shaft worked in a clamp box provided with wheels running on an angle-iron track. Tension was put on the rope by an iron bucket loaded with scrap iron pulling on a three-to-one chain tackle. The rope was of steel and three-quarters of an inch in diameter.

The detail construction of the several parts were described in the paper, also the experiences of operation, the tension on the rope being some 3,200 lbs. The attaching of the pulling chain to the rope was found to be a work of no little difficulty, the rope tending to break

NEW RAILROAD CONSTRUCTION—JANUARY 1, 1891, TO JULY 1, 1891.

NAME OF ROAD.	Track laid between Jan. 1 and July 1.			Under contract or located.		
	From	To	Miles	From	To	Miles
Abbeville & Waycross				Bowens Mills, Ga.	Du Pont, Ga.	70
Abingdon Coal & Iron				Abingdon, Va.	Damascus, Va.	15
Adirondack & St. Lawrence				Poland, N. Y.	Malone, N. Y.	150
Alabama Midland				Rutledge, Ala.	Julian, Ala.	4
Albany, Florida & Northern	End of track	Cordele, Ga.	15			
Altoona & Wopsononock	Altoona, Pa.	Wopsononock, Pa.	8			
Aransas Pass				Harbor Island	Aransas Pass, Tex.	10
Asheville & Craggy Mountain	Asheville, N. C.	Toward Craggy Mt.	2	End of track	Craggy Mt., N.C.	4
Atlantic Coast Line				Fayetteville, N. C.	Rowland, N. C.	42
" " "				A. & R. Junc.	Washington, N. C.	25
" " "				Kingston, N. C.	Jacksonville, N. C.	35
Baltimore Belt				Camden Sta., Balt.	Bayview Junc., Md.	7
Baltimore & Ohio—						
Akron & Chicago Junction	Near Warwick, O.	Chicago Junc., O.	54	Grafton, W. Va.	Bealington, W. Va.	24
Bellingham Bay & Brit. Columbia	Nooksack River	Sumas City, Wash.	8			
Bergen Neck				Jersey City, N. J.	Van Buskirk's Pt.	6
"				Bayonne, N. J.	Kill von Kull, N. J.	2
Birmingham, Sheff. & Tenn. River				Sheffield, Ala.	Margerum, Ala.	22
Bishopville				Bishopville, S. C.	North	20
Bloomsburg & Sullivan				Jamison City, Pa.	Ganoga Lake	15
Boston & Maine				Bondsville, Mass.	Chicopee, Mass.	18
"				Stoneham, Mass.	Near Oak Grove	3
Bridgeport & Decatur				Decatur, Tex.	Bridgeport, Tex.	12
Bristol Belt					At Bristol, Tenn.	7
Bristol, Elizabethton & N. C.				Bristol, Tenn.	Butler, N. C.	36
" " "				Elizabethton	Mountain C., Tenn.	40
Buffalo Dock & Connecting				HamburgCan'l, N.Y.	City Line, Buffalo	7
Caldwell	Great Notch, N. J.	Caldwell, N. J.	4.5			
California & Nevada				Orinda Park, Cal.	Walnut Creek, Cal.	9
Canadian Pacific	Mission Junc., B. C.	Huntingdon, B. C.	10	Stratherne, Man.	Souris Man.	70
" "	Airdrie, Man.	Melita, Man.	27	End of track	Edmonton, Alberta	23
" "	Red Deer R., Alberta	Battle River	70	Melita, Man.	Souris River, Assn.	27
" "	Robson, B. C.	Nelson, B. C.	28	Deloraine, Man.	Melita	24
" "	Sicamous, B. C.	Enderly, B. C.	22	Enderly	Sicamous, B. C.	29
Cape Fear & Yadkin Valley				Mt. Airy, N. C.	State Line	7
Carolina, Greenville & Northern				Estillville, Va.	Hot Springs, N. C.	83
Carolina Midland	Barnwell, S. C.	Allendale, S. C.	17	Barnwell, S. C.	Allendale, S. C.	17
Central Counties				Glen Robertson, Q.	Hawkesbury, Que.	20
Central of Georgia	Troy, Ala.	Saginaw, Ala.	50			
Centralia & Chester	Coulterville, Ill.	Oakdale, Ill.	8	Oakdale	Nashville, Ill.	7
Chambersburg & Gettysburg				Conococheague, Pa	Caledonia, Pa.	6
"				Caledonia	Wolf Hill, Pa.	4
Charleston, Sumter & Northern	Sumter, S. C.	Bennetsville, S. C.	63			
Charlestown Belt	Charlestown, W. Va.	N. & W. R. R.	1			
Chattanooga & Lookout Mountain				Cliff Sta., Tenn.	Lookout Mt., Tenn.	8
Chattanooga Southern	End of track	Gadsden, Ala.	38			
Chesapeake & Ohio	Eagle Rock, Va.	Newcastle, Va.	26	Near Clifton Forge.	Warm Springs, Va.	25
"					At Covington, Va.	31
Chicago, Burlington & Quincy	End of track	Deadwood, S. D.	25	Merino, Wyo.	Belle Fouche, Wyo.	30
Burlington & Missouri River				Bradley, S. D.	Hot Springs, S. D.	12
Chicago & Eastern Illinois				Tuscola, Ill.	Shelbyville, Ill.	37
Chicago, Kansas City & Texas				Smithville, Mo.	Gower, Mo.	17
Chicago, Milwaukee & St. Paul				Necedah, Wis.	Remington, Wis.	19
" "				Lynn, Wis.	North	4
Chicago & New Orleans				Farina, Ill.	Ohio River	130
Chicago & Northwestern	Cryst'l Falls Junc.	Amasa, Mich.	13.3			
Chicago & West Michigan				Traverse City	Petoskey, Mich.	65
" "				Williamsburg	Elk Rapids, Mich.	25
Cincinnati, Jackson & Mackinaw				Addison, Mich.	Jackson, Mich.	20
Cleveland Belt				Cleveland, O.	West Cleveland	6
Clev., Cin., Chicago & St. Louis				Harrison, O.	Richmond, Ind.	39
Cleveland, Wooster & Western				Lodi, O.	Wooster, O.	20
Columbia, Newberry & Laurens	Gary's Lane, S. C.	Dover, S. C.	10.5			
Columbus, Shawnee & Hocking:						
Zanesville Belt				C. & E. Junc., O.	Zanesville, O.	4
Concord & Montreal	No. Weare, N. H.	Henniker, N. H.	6.5	Jefferson, N. H.	Berlin Falls, N. H.	17
Coos Bay, Roseburg & Eastern				Marshfield, Or.	Myrtle Pt., Or.	30
Cornwallis Valley				Centerville, N. S.	Middleton, N. S.	26
Corpus Christi & South America				Corpus Christi	Brownsville, Tex.	150
Crawfish Springs & Round Mt n.				Chickamauga, Ga.	Round M'tn, Ga.	18
Dakota, Wyoming & Pacific				Rapid City, S. D.	West	12
Danville & East Tennessee				Bristol, Tenn.	Damascus, Va.	26
Darien Short Line				Belleville, Ga.	Josselyn, Ga.	30
Deadwood Central	Deadwood, S. D.	Ruby Basin, S. D.	7	Gold Run, S. D.	Bald M'tn, S. D.	8
Deer Creek & Susquehanna				Pleasantville, Md.	Havre de Grace	16
Delaware River & Lancaster				Springfield, Pa.	Lancaster, Pa	36
Delaware, Susque. & Schuylkill				Hazleton, Pa.	Oneida, Pa.	10
"	Drifton, Pa.	Gower, Pa.	35	Stockton, Pa.	Beaver Meadow	2
Denver, Apex & Western				Denver, Col.	Lookout Mt.	13
Drummond County				Carmel, P. Que.	Arthabaskav, Q.	23
Duluth, Pierre & Black Hills				Faulkton, S. D.	Pierre, S. D.	80
"				Aberdeen, S. D.	Faulkton	44
Duluth Transfer	W. Duluth, Minn.	Hazlewood Park	1	Fond du Lac	Duluth, Minn.	20
Duluth & Winnipeg				Cloquet, Minn.	Duluth, Minn.	16
Dunderburg Spiral				*Jones Point, N. Y.	Dund'b'g Mt., N. Y.	13
Dutchess County				*P'hkeepsie, N. Y.	Hopew'l Jc., N. Y.	12
Easton & Northern					At Easton, Pa.	2
East Tennessee, Virginia & Ga.:						
Johnson City & Carolina	Johnson City, Tenn	Embreeville, Tenn.	16			
Elkhart & Western				Elkhart, Ind.	Mishawaka, Ind.	11
Elk Hill Coal & Iron	Near Scranton, Pa.	Dickson City.	1.5			
Escanaba, Iron Mt. & Western				Iron Mount'n, Mich.	Florence, Wis.	14
Fairhaven & Southern	Sedro Junc., Wash.	Fairhaven Mine	7		Lynden, Wash.	8
Fall River Electric Freight					At Fall River, Mass.	20
Fincastle & Troutville				Fincastle, Va.	Cloverdale, Va.	7
Findlay Belt				Findlay, O.	Stuartsville, O.	6
Findlay, Ft. Wayne & Western				Findlay, O.	Fort Wayne, Ind.	56
Flint & Pere Marquette				Noir, Mich.	Detroit, Mich.	24
Florence Northern				Florence, Ala.	Linden, Tenn.	76
Florida, Georgia & Western				Tallahassee, Fla.	Wicissa, Fla.	20
Florida Midland & Georgia				Valdosta, Ga.	Deadman's Bay, Fla	60
Flovilla & Indian Springs	Flovilla, Ga.	Indian Springs, Ga.	8			
Fort Smith, Paris & Dardanelle				Near Ft. Smith	Dardanelle, Ark.	71
Fort Worth & Rio Grande	Comanche, Tex.	South	9	End of track	Brownwood, Tex.	25
Franklin & Tilton	End of track	Tilton, N. H.	.6			
Genesis & Obed River				Crossville, Tenn.	Brown's Coal Bank.	5
Georges Valley				Union, Me.	Warren, Me.	8
Georgetown & Granger				Granger, Tex.	Georgetown, Tex.	15
Georgia Southern & Florida				*Tifton, Ga.	Thomasville, Ga.	52
Macon & Atlantic	Bruton, Ga.	East	11	*End of track	Colleton, S. C.	85
Macon & Birmingham				*La Grange	Birmingham, Ala.	133
Glasgow Belt					At Glasgow, Va.	6
Goodyear, Neillsville & Northern	McKenna, Wis.	Zeda, Wis.	1	Tremont	Neillsville, Wis.	20
Grand Trunk		At Campbellf'd, Ont	2	Kingscourt, Ont.	Glencoe, Ont.	22
"				Waterloo, Ont.	Elmira, Ont.	11
Great Northern Line	Shelby Junc., Mont.	Elk, Mont.	68.7	End of track	Seattle, Wash.	400
Seattle & Montana	Seattle, Wash.	North	10	Near Seattle	Skagit, River	77
Montana Central	Monarch, Mont.	Barker, Mont.	10	Monarch	Neihart Mines	12
Harriman Coal & Iron	Harriman, Tenn.	Walnut Hills	1.5	De Armond, Junc.	Brushy Mt., Tenn.	14
Hearne & Brazos Valley				Hearne, Tex.	Brazos River	10
Houston Belt					At Houston, Tex.	15
Huntington & Big Sandy	Kenova, W. Va.	Huntington, W. Va.	12			
Huron Bay & Iron Range				Champion, Mich.	Huron Bay, Mich.	35
" "				Champion	Republic, Mich.	15
Interoceanic	Jalapa	Near Vera Cruz	55			
Irondale, Bancroft & Ottawa				Irondale, Ont.	Monmouth, Ont.	10
Jack., Mayp't & Pab. Ry. & N. Co				Arlington, Fla.	South Jacksonville	4.5
Jacksonville Mining & Mfg. Co.				Tredegar, Ala.	Iron Mt., Ala.	10
Kanawha & Michigan				Malden, W. Va.	Kanawha Falls	25
Kansas City, Ark. & New Orleans				Hazen, Ark.	Stuttgart, Ark.	22
Kansas City, Bentonv. & S. E.				Bentonville, Ark.	Pineville, Mo.	25
Kansas City, Nevada & Ft. Smith				Amoret, Mo.	Hume, Mo.	12
Kansas City Suburban Belt	Blue River, Mo.	Brush Creek, Mo.	6			
Kansas City, Watkins & Gulf	Near St. Ch'rles, La.	North	20	End of track	Alexandria, La.	70
Kentucky & Indiana Bridge—						
New Albany Belt & Terminal		At N. Albany, Ind.	1			
Kentucky Union				Jackson, Ky.	East	15
Kewaunee, Green Bay & Western				Kewaunee, Wis.	Green Bay, Wis.	25
Kinnickinnick				Kinnickinnick, Ky.	Mines	8
Lake Shore & Mich. Southern				Silver, N. Y.	Dunkirk, N. Y.	8
Lancaster & Hamden				Near Lancaster	Wellston, O.	30
Lancaster, Oxford & Southern				Quarryville, Pa.	White Rock, Pa.	8
" " "				Oxford, Pa.	Singerly, Md.	14
" " "				Oxford, Pa.	Landenburg, Md.	14
Lehigh & Hudson River	Hamburg, N. J.	Franklin, N. J.	2			
Lehigh Valley—						
Buffalo & Geneva				Buffalo, N. Y.	Geneva, N. Y.	98
Geneva & Van Ettenville				Geneva, N. Y.	V'n Ett'nville, N.Y.	57

NEW RAILROAD CONSTRUCTION—JANUARY 1, 1891, TO JULY 1, 1891.—Continued.

NAME OF ROAD.	Track laid between Jan. 1 and July 1.			Under contract or located.		
	From	To	Miles	From	To	Miles
Lehigh Valley		Newark, N. J	2 5	Newark	Jersey City, N. J	6
Little Falls & Dolgeville				Rushville, N. Y	Rochester, N. Y	12
Los Angeles Terminal	Los Angeles, Cal	San Pedro, Cal	20	Little Falls, N. Y	Dolgeville, N. Y	12
Louisiana, Arkansas & Missouri				Trippe, Ark	Delhi, La	81
Louisville & Nashville	Pond Sta., Tenn	Cumberl. Furnace	16			
" "	Near Hubbard's Spr	Norton, Va	41	Vanleer, Tenn	Near Clarksville	21
Louisv., New Albany & Chicago—						
Fort Wayne, Terre H. & S. W.				Bainbridge, Ind	Brazil, Ind	20
Lower Laurentian	Reviere Pierre	St. Tite, Que	13	Three Rivers, P. Q.	Piles, P. Que	20
Macon, Dublin & Savannah	Dry Branch, Ga	Dublin, Ga	44			
Mahoning Valley	Helvetia, Pa	Falls Creek, Pa	10	Punxsutawny, Pa	Clearfield, Pa	42
Manhattan Elevated	170th St., N. Y. C	177th St	1.5		In New York City	15
" "	132d St., N. Y. C	Willis Ave., N. Y	.5			
Manistee & Grand Rapids				Sable River, Mich	C. & W. Mich. June	21
" " "				Oak Park	Manist. Riv., Mich.	5
Manistee & Northeastern	Interlochen	Lake Ann, Mich	7			
Massawippa Junction				Coaticook, P. Que	Ayers Flat, P. Que	15
Mexican Central				Tula, Mex	Pachucah, Mex	45
Mexican International				Toucon, Mex	Durango, Mex	100
Mexican Northern	Near Coahuila	Sierra Mojada, Mex	22			
Mexican Pacific	Near Tunala	Tuxtla	30			
Mexican Southern	Tepeaca, Mex	Tecomavaca	100	Tecomavaca	Oajaca, Mex	90
Middle Georgia & Atlantic	Eatonton, Ga	Machen, Ga	20	Machen	Covington, Ga	26
" " "				Newborn, Ga	Social Circle, Ga	11
Middlesborough Belt				Bennett's Fork	New Cabin F'k, Ky	6
				Stony Fork Creek	Coal Mines, Ky	4
Middletown & Cincinnati	Near Middletown, O	Southeast	5	End of track	King's Station, O	7
Midville, Swainsboro & Red Bluff				Swainsboro, Ga	Augusta, Ga	55
Millen & Southern	Thrift, Ga	North	7	End of track	Millen, Ga	3
Minn., St. P. & Sault Ste. Marie				Boynton, N. D	Coteaus	12
" " " "				Hankinson, N. D	Jamestown, N. D	105
Mississippi & Little Rock				Duncan, Ark	Little Rock, Ark	61
Mississippi River & Bonne Terre				Bonne Terre, Mo	Doe Run, Mo	17
Missouri, Kansas & Texas	Milford, Tex	Hillsboro, Tex	14 1			
Missouri Pacific	Union, Neb	Plattsmouth, Neb	12			
Houston, Cen. Ark. & Northern.	Alexandria, La	North	3	Riverton, La	Alexandria, La	75
Mobile, Jackson & Kansas City				Mobile, Ala	Jackson, Miss	183
Mobile Transportation Co				Mobile, Ala	Portersville	20
Montgomery, Tus. & Memphis				Montgomery, Ala	Tuscaloosa, Ala	107
Montreal & Ottawa				Rigaud, Ont	Ottawa, Ont	77
Montreal & Western	St. Sauveur, Que	Ste. Adele, Que	8	Ste. Adele,	Chute aux Iroquois	40
Monterey & Mexican Gulf	Near Guadalupe	Tampico, Mex	98			
Morristown & Cumberland Gap				Morristown, Tenn	Corryton, Tenn	44
Mount Carmel & Natalie				Mt. Carmel, Pa	Natalie, Pa	6
Mount Moosilauke				Warren, N. H	Mt. Moosilauke	20
Nash., Chattanooga & St. Louis	End of track	Guntersville, Ala	4	Guntersville	Bell Factory, Ala	42
Nashville & Knoxville	Cookeville, Tenn	East	10	End of track	Cin. So. R. R	70
New Albany Highland	New Albany, Ind	Scenic Park	2			
New Caledonia				Conocoheague Isl'd	Caled. Mines, N. S	5
New Glasgow Coal & Iron				Glasgow, N. S	Mine in Pictor Co	10
New Orl., Ft. Jack & Grand Isle	Socola Sta., La	Grand Bayou, La	1.3			
" " "	Socola Sta	Rabasse, La	12.3	Rabasse	Sunuise, La	5
New Orleans & Northwestern				Rayville, La	Bastrop, La	24
Newport & Shermans Valley	Bloomfield Junc	Loysville, Pa	7.1	Loysville	Blain, Pa	10
Norfolk, Alber. & Atlantic				Jacksons, Va	Albm. Sd., N. C	35
Norfolk & Western				Ivanhoe, Va	Crozer mines, Va	
" "	End of track	Norton, Va	9	Virginia City	Coal mines	2
" "	Elkhorn, W. Va	End of track	13			
" "	Kenova, W. Va	Wayne C. H	22	Near Elkhorn	Ironton, O	157
" "		Ohio River	7			
Northern Pacific	W. of Chehalis, W	Towards S. Bend	4.8	End of track	South Bend, Wash	52
" "	Centralia, Wash	E. of Elma, Wash	7	Volmer, Id	Lewiston, Id	49
" "	W. of Mo., Messano	Toward Ocosta, W	2.3	Near Montesano	Aberdeen & Ocosta	24
" "	Lake View, Wash	East of Olympia, W	2.1	Lake View	Harlowe Jc., Wash.	2
" "	E. of Harlowe Junc	Towards Olympia	18			
Lake Washington Belt	Renton, Wash	Lake Washington	4	Black River Junc	Lake Washington	23
" "				Williams Creek	Nedlocks, Wash	*10
North Mexican Pacific				Deming, N. Mex	Palomas, Mex	45
Nova Scotia Midland				New Glasgow, N. S	Suyborn Co., N. S	60
Ohio & Mississippi	Riverdale, Ind	Stone quarries	2			
Ohio River	Ravens'd, W. Va	Leroy, W. Va	17	Leroy	Spencer, W. Va	16
Oil Valley	Watsonville, Pa	Wilbur, Pa	5			
Old Colony	Walpole, Mass	East Walpole	4	East Walpole	Winslows, Mass	2
Oregon Improvement Co.—						
Port Townsend Southern	Lake Hooker, Wash	Quilcene, Wash	8	Union City	Olympia, Wash	25
" " "	Olympia, Wash	North	2.5			
Seattle & Northern	End of track	Hamilton, Wash	6			
Ottawa & Gatineau Valley	Peche, Ont	North	2	End of track	Chelsea, Que	20
Paducah, Tennessee & Alabama	Tenn. State Line	Paris, Tenn	15			
Pajaro Valley				Moro Cojo, Cal	Salinas, Cal	13
Parry Sound Colonization	Parry Sound, Ont	East	10	End of track	Emsdale, Ont	47
Pecos Valley				Eddy, N. M	Roswell, N. M	90
Pennsylvania	Morrisville, Pa	Norristown, Pa	35	Norristown	Frazer, Pa	15
"				Pultney Bottom, Pa	Powhattan, O	13
"				Waverly, N. J	New York Bay	6
"				Kaylors, Pa	Brubaker, Pa	25
"				Stewart, Pa	Murraysville, Pa	7
Penobscot Central				Castine, Me	Milo, Me	80
Perry County				New Bloomfield, Pa	Loysville, Pa	12
Philadelphia Belt Line					At Philadelphia, Pa	25
Philadelphia & Reading	Bowmansdale	Harrisburg, Pa	9	Bound Brook, N. J	Arthur Kill, N. J	20
"	Timber Creek	Spring Mills, N. J	8	Lofty, Pa	Hazleton, Pa	10
Philadelphia & Sea Shore	Tuckahoe, N. J	Sea Isle City, N. J	10	Tuckahoe, N. J	Cape May, N. J	28
Phillips & Rangely	Dead River	Rangely, Me	6			
Pittsburgh, Akron & Western	Rocky River, O	Akron, O	19			
Pittsburgh & Moon Run				Groveton, Pa	Remington, Pa	6
Pittsburgh, Shenango & Lake E	Dixonburg, Pa	Wallace Junc., Pa	25.5	Cranesville Junc	Conneaut Harbor	12
Pittsburgh & Western	Stone quarries	Windsor, O	8			
"	Nor. Sewickley, Pa	Rock Point, Pa	3.3			
Plymouth & Middleboro				Plymouth, Mass	Middleboro, Mass	16
Port Arthur, Duluth & Western				Stanley, Ont	Near Griffin Lake	40
Port Clinton Short Line				Port Clinton, O	Short Line Junc	12
Portland & Rumford Falls				Gilbertville, Me	Rumford Falls, Me	15
Quebec Central				Tring, P. Que	Lake Megantic, P.Q	52
Raritan River				N. Brunswick, N. J	Bound Brook, N. J	7
Reading & Southwestern				Reading, Pa	Mohrsville, Pa	5
Red River & Southwestern				Henrietta, Tex	Archer City, Tex	30
Richmond & Danville	Tomotla, N. C	Murphy, N. C	9.2			
North Carolina Midland	Wilkesboro, N. C	Mockville, N. C	26.7			
Yadkin	Bilesville, N. C	Norwood, N. C	23			
Richmond, Nicholasv. Irv. & B.	Richmond, Ky	Centerville, Ky	11.5	Centerville	Irvine, Ky	21
" "				Irvine	Beattyville, Ky	35
Richmond & Tidewater				Rich. & Danv. R. R.	Tomah'k Ch'ch. Va	5
Rio Grande Southern	Vance Junc., Col	South	10	Vance Junc	Durango, Col	125
Rio Grand Western	Manti, Utah	South	15	End of track	Marysville, Utah	55
Roanoke & Southern	Smith River	Martinsville, Va	4			
" "	Martinsville	Toward Roanoke	20	End of track	Roanoke, Va	40
Rockaway Valley	Peapack, N. J	Mendham, N. J	6	Mendham, N. J	Morristown	7
Rogue River Valley	Jacksonville, Or	Medford, Or	3			
St. Albans & Coal River				St. Albans, W. Va	Madison, W. Va	42
St. Joseph's Valley				Berrien Sprs., Mich.	Benton Har., Mich.	20
San Antonio & Aransas Pass				Lott, Tex	Lexington, Tex	50
San Francisco Belt		At San Francisco	.7	Wharf streets	At San Francisco	2
Savannah, Americus & M'tgomery	Near Louvale, Ga	End of track	45	Near Hurtsboro	Montgomery, Ala	30
Seaboard & Roanoke	Murfreesboro, N. C	Pendleton, N. C	6.5			
Georgia, Carolina & Northern	Savannah River	Near Athens, Ga	30	End of track	Athens, Ga	15
				Athens	Atlanta, Ga	55
Seattle, Lake Shore & Eastern	Woodv. Junc., W'sh	Intern. line	23			
Silver City & Northern	Whitewater, N. M	Ft. Bayard, N. M	12	Fort Bayard	Hanover, N. M	6
Silver Springs, Ocala & Gulf	Elliston, Fla	Hernando, Fla	7.5	Homosassa, Fla	Brooksville, Fla	35
South Bound	Michord, Ga	Savannah River	20			
" "	Deers Mill P'd, S. C	Savannah River	30	Deers Mill Pond	Columbia, S. C	80
Southern Pacific				Near Comstock	Shumla, Tex	13
" "	Avon, Cal	San Ramon, Cal	21			
" "	Firebaughs	Armona, Cal	58			
" "	Coburg, Or	Springfield, Or	13			
South Florida				Phosphate City	Bartow, Fla	7
" "				Pemberton, Fla	Dunnellon, Fla	40
South Fork				South Fork Sta., Pa	Yellow Creek	12
Staunton Belt				Staunton, Va	Company's mines	3
Stuttgart & Arkansas River	End of track	De Witt, Ark	3	De Witt	Pendleton, Ark	19
Tacoma Eastern				Com'menc. Bay, W	South	6
Temiscouata				Clairs, N. B	Connors, N. B	12
Tennessee Midland		At Memphis, Tenn	2.5	Perryville, Tenn	Nashville, Tenn	92
Tenn. River, Ashville & Coosa				Ashville, Ala	Coosa River	10
Terminal City				Mulgrave, N. S	Terminal City, N. S	6

quite often at the joints. Difficulty was also found in taking hold of the cars. However, a half-inch pin was driven into the side bar of each car, and the end of the pulling chain provided with a ring slipped over the pin. The original speed was to be 250 ft. per minute, but this was reduced to 180 ft. per minute, in consequence of trouble being met in hooking on to the sides of the car. Two cars were pulled at one time and the starting load was found by dynamometer test to be about 25 per cent. of the weight of the cars, and the tractive force between 2 and 4 per cent. of the weight of cars.

The second problem was carrying dirt cars from the Susquehanna Coal Co.'s No. 6 breaker to the dirt plane, a distance of some 600 ft., returning the empty cars to the breaker. About 500 three-ton cars are taken care of daily, being hoisted on a long plane out of the valley and dumped on opposite side of the mountain. The hauling rope was stretched on the surface. The driving arrangements are similar to that previously described.

Numerous queries were made as to detail construction, and Mr. J. F. Holloway described an arrangement of early cable haulage in a mine slope in Maryland, of which he had the construction some years since.

A belt dynamometer was next described in a paper read by S. P. Watt, of Cincinnati, O. It consisted of a set of pulleys mounted on a suitable frame and arranged to connect with each other by belt. A driving belt being connected, its efficiency can readily be determined by the use of a prepared brake attachment.

A BELT TESTING MACHINE

was described in a paper by Prof. George I. Alden. The professor stated that all such machines should meet the following requirements: They should give accurately the sum of the belt tensions, the power transmitted, from which the differences of tensions can readily be found, the number of revolutions of both driving and driven pulleys, and the number of runs of the belt during the whole trial, also during any interval of the trial. It should be capable of adjustment to a constant load, and to any load within the capacity of belt to be tested; of adjustment at a change of load without changing the sum of the tensions, also to any constant load within the sum of the tensions when varied. It should give the arc wrapped by the belt on both driving and driven pulley.

The next paper read was that of John T. Henthorn, describing a

TEST OF THE TRIPLE EXPANSION ENGINE

of the Elm Street Station of the Narragansett Electric Lighting Company, of Providence. The results of the test gave 12.94 lbs. of water used per indicated horse power per hour under a steam pressure of 125 lbs. to the square. The engines were designed to take steam of 160 lbs. pressure. With the higher pressure it is expected that the water used per horse power will be reduced to 12.6 lbs.

After the reading of the paper, the election of 101 new members, and 36 new juniors, was announced, making a total membership of about 1,350. Notice of a proposed amendment to the by-laws was given, wherein it is provided that the nominating committee shall be directed to propose two names to be voted for, for each office. It stands over to the next meeting.

The Committee on a Standard Method of Testing Materials, also that on a Standard Method of Testing Locomotives, reported progress. This ended the morning session of Tuesday.

At 2 p. m. of the same day the works of the Gorham Manufacturing Co. were visited. The party numbered some 200 gentlemen and 65 ladies, the largest visiting company the Gorham establishment has ever entertained. A souvenir silver spoon, encased in a handsome box, was presented to each lady upon leaving. The men then went to the works of the Nicholson File Co., and the Rhode Island Locomotive Works, where a free examination of every detail, important and unimportant, was permitted.

At the evening session of the same day Prof. D. S. Jacobus lead with a paper giving "A comparison of the economy of compound and a single cylinder Corliss engines, each expanding about 16 times." The comparison showed an economy of some 30 per cent. in favor of the compound engine. Objection was raised by Prof. C. H. Peabody to the 16 expansions in a single cylinder. "It should have been 8 or 10 expansions, no more."

The next paper read was that of Professor De Volson Wood on the "Flexure of Elastic Rings." The paper was a mathematical solution of a problem proposed several years ago by Prof. John E. Sweet, of the Straight Line Engine Works.

The paper following was by F. A. Halsey, of Sherbrooke, P. Q., on the "Premium Plan of Paying Labor." A comparison was made between time work, piece work and premium-paid work, based upon the experience of the writer. The paper gave rise to the narrating of various experiences and an expression of opinions based upon such experiences. The opinions were equally divided between all three methods, showing no possibility of a settled conclusion as yet. The main feature of the discussion and debate was a doubt of and a demand for the "golden rule" as a governing element of the problem.

A paper by Prof. R. C. Carpenter, of Ithaca, N. Y., on the "Application of Hirn's Analysis to Engine Testing and a Method of Measuring Directly the Quality of the Steam in Clearance Spaces," was read; also a paper by Prof. C. H. Peabody on the "Application of Hirn's Analysis to Multiple Expansion Engines." These papers were too heavy and too mathematical for the practical members. Profs. Alden, Sweet, Peabody and Carpenter absorbed the discussion. At the end of the session it was announced that the Union Railway of Providence had sent notification that the society badge would pass the wearer upon any line of street cars during the convention.

At the Wednesday morning session the first paper taken up was that of Prof. R. C. Carpenter on "Notes Regarding Calorimeters," in which is contained a discussion of some experiments regarding the best methods of obtaining steam for calorimeter uses, a proposed classification of calorimeters, and a general discussion and description of some of the various known classes, also a short description of one or two forms of new calorimeters. The principal portion of the paper, however, is devoted to a throttling calorimeter and some rapid methods of reducing the determinations, for which purpose some diagrams and tables are given.

In the discussion, Professor Peabody described several other forms of calorimeters, stating that endeavors had been made to improve the throttling calorimeter, but he had found the old forms the best and most reliable.

Prof. Burkitt Webb, of Stevens', felt quite elated at being able to be present a paper on

JET PROPULSION,

stating that a year or two ago, when the subject was a live one in certain quarters, several studens took special

NEW RAILROAD CONSTRUCTION—JANUARY 1, 1891, TO JULY 1, 1891.—Continued.

NAME OF ROAD.	Track laid between Jan. 1 and July 1.			Under contract or located.		
	From	To	Miles	From	To	Miles
Tobique Valley	Near Andover, N B.	Toward Plaster R'k	6	End of track	Plaster Rock, N. B.	8
Toledo, Ann Arbor & North Mich.				Marion, Mich	Mackinaw, Mich	90
Toledo, Columbus & Cincinnati	Kenton, O.	Ridgeway, O.	9			
Torbrook Coal & Iron	Wilmont, N. S.	Mines	2	End of track	Torbrook, N. S.	6
Union Pacific				*Portland, Or.	Seattle, Wash	185
" "				*Urton, Utah.	Ploche, Nev	137
Utah Central				Park City, Utah	Provo River, Utah.	25
" "				" "	Heber City, Utah.	8
" "				" "	Weber Canon, Utah	20
Valley (Mont.)				Helena, Mont.	Missouri River	17
Vanegas, Central & Rio Verde				Pachon, Mex.	Potners, Mex.	8
Wadena & Park Rapids				Wadena, Minn	Park Rapids Minn.	36
" " "				Wadena	Eagle Bend, Minn	19
Washington City & Point Looko't				Mechanicsville, Md	Point Lookout, Md.	60
Watauga Valley				Watauga, Tenn	Watauga Pt., Tenn	5
West End Connecting				West End, N. J	Bergen Pt., N. J	7
Westerly & Jewett City				Westerly, R. I.	Jewett City, Conn.	25
Western Counties	Smith's Cove, N. S.	Digby, N. S.	3			
Western Maryland				Arlington Sta., Md.	Colgate Creek	10
" "				Williamsport, Md.	Cherry Run, Md.	14
West Virginia, Central & Pittsb				Elkins, W. Va.	Beverly, W. Va.	8
" " " "				Elkins	Bealington, W. Va.	17
Western Virginia & Pittsburgh	Burnsville, W. Va.	Sutton C. H.	20	Shaversv., W. Va.	Williams River	35
" " "	B'khannon, W. Va.	Newlon, W. Va.	26	Newlon, W. Va.	Florence, W. Va.	9
Wheeling & Lake Erie				Portland, O.	Bellaire, O	12
Wilmingt'n, Ch'dbourn & Conway	Chadbourn, N. C.	Hub, N. C.	12			
Wilmingt'n, Onslow & E. Carolina	Winona, N. C.	Jacksonville, N. C	5	Jacksonville	New Berne, N. C.	30
Winona & Southwestern	Spri'g Valley, Minn	Osage, Ia.	37			
Wisconsin Central	End of track	Greenwood, Wis.	17.5			
Wrightsville & Tennille				Dublin, Ga.	Abbeville, Ga	40

*Work suspended.

interest in the principles involved. At that time he laid down a law, enforced by illustration and argument, but it so happened that the principles, like many other good ones, were unacceptable to the unregenerate mind. "When, therefore," says the professor, "I learned that some one had gone away and had quietly tried the thing I experienced one of those moments of satisfaction which come to every successful laborer in a good cause. I was glad that Nature had had a chance to vindicate her own laws." The paper presented a letter from an ex-student of the professor's, describing a test to prove that the reaction of the jet is the same in air as in water. The ex-student, a Mr. Charles T. Everett, Jr., made the test to disprove a statement that a stream of water issuing from a nozzle under water reacts upon the surrounding water, and tends to drive the nozzle in the opposite direction to that of the jet, in the same way that a solid rod issuing from the same nozzle would react upon a stone wall. The results of the test show the reaction of both the air and water to be practically the same. In both cases the pressure of water was 100 lbs. per sq. in., the jet reaction 4 lbs., the velocity 122 ft. per second.

This paper gave rise to a quite spirited discussion and a comparison of old experiences. A naphtha-launch experiment was described in which water was drawn into the propeller wheel through a conical tube and then discharged, giving the propeller a pulling rather than a pushing power. When operated at the wharf a spring balance showed an increase in the pulling power. When free the spring fell off some 15 per cent., due, it was thought, to water resistance. It was thought that a jet could not be well employed, since a pumping engine would have to be used, and the pump requirements would be so great that the power could not be applied with economy. Prof. Webb, in closing the discussion, stated that the main object of the paper was not to write all that was possible on the subject, but simply to put a fact in shape to be understood.

A second paper by Prof. Webb was next read, the subject being "A Steam Reaction Wheel." The paper presented some additional points as addenda to some previous papers specially calling attention to the necessity of considering in such commutations, namely, the change of density and wetness of the steam as it escapes through and the increase of pressure from centrifugal force as it approaches the orifice. The author discussed in detail a 15 H. P. reaction wheel, one foot in diameter, specially shaped, with a speed of 4,000 revolutions per minute under a boiler pressure of 70 pounds or less absolute. He deduced a law concerning the reduction of pressure required for the production of the necessary velocity by expansion, and entered into the consideration of the sizes of throat necessary to pass the quantity of steam desired, and the form of nozzle to be used. Prof. Sweet discussed the relative efficiency of the steam reaction wheel and the steam turbine, illustrating shapes, points, etc., by blackboard sketches.

TOPICAL DISCUSSIONS.

Upon the query as to "What is better economy in a foundry cupola—to melt rapidly, producing a relatively cool iron? or to melt more slowly, producing hotter iron?" Mr. Webber stated that at the Erie City Iron Works 100 tons of iron were melted per week in a 60-in. cupola, at a rate of 8 tons per hour. The ratio of iron to fuel is 7½ to 1, and the efficiency of the metal is 75¾ per cent. Desiring to increase the capacity of the cupola, an attempt was made to melt 12 tons per hour instead of 8. The result was 11½ tons per hour with 9½ to 1 ratio of iron to fuel, and an efficiency of 75 per cent. in the iron melted, lacking only three quarters of one per cent. of the slow melting; the 75 and 75¾ per cent. of the melting went into good castings. Quicker heating produced a considerable saving in cost of melting.

Upon the query as to the number of times per minute a dash pot can be moved as applied to Corliss valves, there appeared to be considerable uncertainty; 160 to 170 lifts per minute were known to have occurred.

At this point the President gave notice that the council had decided to hint and request that cameras, if carried on the visiting trips, be left in the office of the establishment visited; the reason could well be understood.

A paper on "Heat Transmission through Cast-Iron Plates Pickled in Acid" was read by Daniel Royse. The object and aim of the paper are shown in the concluding paragraph, as follows: "It is expected that when, as is now proposed, this treatment is applied to the surfaces bounding the clearance spaces of a steam cylinder the extent to which the iron so treated will store and restore heat introduced into the engine by the steam will be diminished about 40 per cent., and thus some practically useful reduction of the internal wastes will be effected. In the engine the varnish is relied upon to retard the interchange of heat and the alteration of surface produced by the action of the acid is expected to render the varnish more adhesive and permanent." Prof. Peabody, in the discussion, said that he thought the surfaces of engine cylinders should be treated in a similar manner, and an opportunity given to see if any economy in surface condensation resulted therefrom.

A paper on the "Ideal Engine," presented by Prof. Thurston, was read by the Secretary. There was no discussion. Next came a paper on the effects of the "Steam Jacket on Cylinder Condensation," by W. W. Bird, of Cambridgeport, Mass. This paper details the results of experiment in regard to the effect of the steam jacket on cylinder condensation and the resulting engine economy. The experiments were made on an upright single-acting compound engine of 5¼ and 9 in. diameter of cylinders and 8 in. stroke, indicating about 10 H. P. A continuation of this paper is promised for a future meeting.

Prof. Rogers, of Colby University, Waterville, Me., presented two papers, which were read by himself. Their titles were, "A Method of Dividing an Index Plate into 1,000 Equal Parts" and "An Additional Contribution to the Perfect Screw Problem." In the first paper it is stated that an attempt was first made to reproduce a graduated disk purchased of a maker having considerable reputation, but, upon investigating a provisional transfer, quite large errors of a systematic character were discovered. While the relative errors of adjacent subdivisions were very small, the cumulative errors were very large. The faulty reproduction was therefore abandoned and the Rogers machine produced.

In the second paper Prof. Rogers describes a machine of his own design built by Messrs. Webber & Philbrick, of Waterville, Me. After describing the operation of the machine, Prof. Rogers stated that he did not care to describe the method by which the systematic errors of a single revolution of the screw were eliminated; he preferred his personal methods of protection to the security of a patent. He could safely state, however, that the method is applicable to screws of almost any degree of badness.

STEEL CASTINGS.

An attractive paper was read by Henry L. Gantt, of the Midvale Steel Works, describing some of the ups and downs of casting steel. A lively discussion followed the reading of the paper, the chief point being the real importance of blowholes in the metal. C. H. Parker, of Cambridgeport, Mass., spoke favorably of them, and was glad to hear a good word in their favor from others. However, he said the Government officers objected to such conditions and rejected everything on the least appearance of blowholes. Some steel castings he had made upon Government orders were to withstand a working pressure of 160 lbs. to the square inch and a test pressure of 240 lbs. The inspection was entirely satisfactory under a test pressure of 300 lbs., but as Mr. Parker had made no attempt to conceal the blowholes he was notified that the Government would under no condition accept them. Mr. Mohr, of Chicago, said that the Government in all cases calls for high-class work, and is willing to pay for it; seven cents represents the price for commercial work and fourteen cents for Government work. Thomas R Morgan, of Alliance, O., discussed the commercial aspect with force and emphasis, detailing the possibility of warranted work with proper attention to details.

The afternoon of Wednesday, the 17th, was occupied in a visit of the members to the works of the Wm. A. Harris Steam Engine Co., of the Brown & Sharpe Manufacturing Co. and the Armington & Sims Engine Co., at each of which places the members were shown every courtesy and privilege. They could wander about independently or collectively, examine any specialty desired and were met with every explanation. The variety and excellence of the work of the Brown & Sharpe Co. has to be seen to be appreciated. Of course with the engine construction all were familiar, but the visitors were not slow to take advantage of the facilities offered by the Harris company and Armington & Sims. A fine display of engines in operation was made by the latter company, showing the several sizes and varieties ready for delivery. Every engine is tested to a perfect operation before it is allowed to leave the premises.

Wednesday evening was devoted to a reception tendered to the society by the citizens of Providence. The Governor of Rhode Island, Hon. H. G. Ladd, received the guests.

The morning of Thursday, the 18th, was passed in reading papers and attending to the closing business of the meeting. Mr. H. M. Howe opened the session with his paper on

MANGANESE STEEL,

of which the following is an extract:

Manganese steel is an alloy of iron and manganese, incidentally and probably unavoidably containing a considerable proportion of carbon.

The effect of small proportions of manganese on the hardness, strength and ductility of iron is probably slight. The point at which manganese begins to have a predominant effect is not known; it may be somewhere about 2.5 per cent. As the proportion of manganese rises above 2.5 per cent. the strength and ductility diminish, while the hardness increases. This effect reaches a maximum with somewhere about 6 per cent. of manganese. When the proportion of this element rises beyond 6 per cent. the strength and ductility both increase, while the hardness diminishes slightly, the maximum of both strength and ductility being reached with about 14 per cent of manganese. With t is proportion the metal is still so hard that it is very difficult to cut it with steel tools. As the proportion of manganese rises above 15 per cent. the ductility falls off abruptly, the strength remaining nearly constant till the manganese passes 18 per cent., when it in turn diminishes suddenly.

Steel containing from 4 per cent. to 6.5 per cent. of manganese, even if it have but 0.37 per cent. of carbon, is reported to be so extremely brittle that it can be powdered under a hand-hammer when cold; yet it is ductile when hot.

We have here another of the endless cases in which the properties of the alloy differ greatly from the mean of those of its components. This usually astonishes the novice, and even experienced metallurgists are often betrayed by it into expressions of surprise. It is, in fact, about as surprising as the parallel fact that the properties of water are not the mean of those of oxygen and hydrogen, and that those of peroxide of hydrogen are not directly deducible from those of water and oxygen.

Passing by such striking properties of manganese steel as its freedom from blowholes; the great difficulty with which it welds; the increase in its toughness caused by quenching from a yellow heat; its electric resistance, enormous, and very constant with changing temperature; its low thermal conductivity.—passing these by, one group of qualities stands out as that which must create and yet limit its value in the arts. I refer to its remarkable combination of great hardness, which cannot be materially lessened by annealing, and great tensile strength, with astonishing toughness and ductility; this group, I say, must at once create and limit its usefulness. The very fact that the manganese-steel cannot be softened, that it ever remains so hard that it can be machined only with great difficulty, at once sets up a great barrier to its usefulness; yet a barrier which, as we shall soon see, is not so insurmountable as it might at first appear.

On the other hand, if, as I believe, this cheap metal has a much higher combination of the important properties of hardness and ductility than exists in any other known substance, metallic or non metallic, we can hardly hesitate to prophesy for it an important and useful future, for we can hardly doubt that for some important purposes this combination is extremely desirable.

The discussion indorsed the paper in every point and assertion.

A paper read by Prof. Denton, of Stevens Institute, gave the

PERFORMANCE OF A PUMPING ENGINE AGAINST A HEAD OF 2,000 FT. OF WATER.

The pumping engine discussed is a Worthington pump used on the Standard Oil Pipe Line connecting New York City with Olean, Pa. It is located in a valley of the Allegheny Mountains at Swartout, about four miles from Port Jervis, N. Y. The results of the test are cited as follows:

First.—The boiler economy of the station is equivalent to 9.1 and 9.8 lbs. evaporation per pound of pea and stove anthracite, respectively, from the actual temperature of feed, 147 degrees Fahr., and average steam pressure of 90 lbs. above the atmosphere. It is probable that an evaporation greater than 10 lbs. per pound of coal, under working conditions, could easily be obtained with the best bituminous coal.

Second.—The average economy of the engine is represented by either of the following statements:

[a] The steam consumed per hour per horse power pump end is	17.0	lbs.
[b] The steam consumed per hour per horse power steam end is	16.4	"
[c] The duty per 100 lbs. of coal, if the boiler supplies to the engine 10 lbs. of steam per pound of coal burned, is	116.5	mils. ft. lbs.
[d] The duty per each million thermal units of heat imparted to the feed water by the boilers neglecting steam used by feed pumps is	109.5	" "
[e] Ditto, including steam used by pump, if latter exhausts into feed water	109.3	" "

Third.—The engine works smoothly while pumping against upward of 900 lbs. pressure per square inch. Under fluctuations of steam pressure amounting to 5 per cent. and of oil pressure amounting to 10 per cent., the engine maintains an average length of stroke within 3-32ds of an inch of a maximum possible stroke of 37.85 in., or within 0.33 per cent. The greatest variation of individual strokes was 9-32ds of an inch, or 1.0 per cent.

Fourth.—The steam condensed in the jackets and reheater in per cent. of the total steam supplied to engine is 15.8 per cent

Fifth.—The power wasted in friction of the mechanism and operating the two air pumps, in per cent. of the horse power of the steam end, is 3.6 per cent.

Sixth.—The actual delivery of oil was within 1.36 per cent. of the cubical displacement of the pump plungers, or the "slip" was 1.36 per cent.

Seventh.—Without the use of steam in the jackets and reheater, water accumulates in the steam cylinders in an hour's time to such an extent as to be heard to splash against the pistons, while the loss of mean effective power, principally in the low cylinders, causes at least 10 per cent. loss of speed, which is probably attended with a considerable loss of economy, but to what extent was not determined. The use of steam jackets is undoubtedly necessary to the successful operation of a steam engine of this particular type.

The methods of making observations and recording results were highly praised.

Fred W. Gordon, of Philadelphia, presented a paper on

A BLAST-FURNACE BLOWING ENGINE.

The object of the paper was to call for "comment and criticism on a form of blast-furnace blowing engine whose details are the result of an effort to design a standard form for such machinery." The engine is provided with a good substantial platform for ready access to every valve. The total weight of the engine is 100 tons. It is designed to blow as high as 15 lbs. pressure per square inch at 40 revolutions per minute, delivering 15,000 cu. ft. of blast per minute, piston measurement. J. F. Holloway, of New York, in the discussion, said he thought well of American blowing-engine practice. Leakages in a blowing engine are imperceptible in themselves, but form in the aggregate an enormous portion of the work. The quick-stroke engine, from the shorter time the piston consumes in its travel, eliminates a part of this wastage within the cylinder. The principles of blowing-engine practice are peculiar, to meet trying conditions. The large quantity of air to be delivered under pressure requires a large piston. In the steam cylinder the heaviest resistance is met when the steam is exhausted, and this accounts for the immense amount of iron put into blowing engines. It is indeed a matter of necessity that steam shall be used as it is used, and a maximum of metal adopted.

The next paper was on some "Experiments with a Screw Bolt," by James McBride. Mr. McBride's conclusions were as follows: That 89.8 per cent. of the power applied at the wrench is absorbed by the friction of the nut on the washer and on the threads of the bolts; that while the tests mentioned, crudely made as they were, are not considered absolutely correct, they tend to show that only about 10 per cent of the power applied is converted into strain on the bolt.

After a short discussion of Mr. McBride's paper, Mr. Wm. R. Roney read his paper on "Mechanical Stokers."

The paper was a historical record of the progress of mechanical stoking, ending with a description of the Roney stoker, and of some tests made to ascertain the economy to be attained by its regular use.

The topical question, "Can a water pyrometer be made to work successfully for high temperatures?" was then taken up. Mr. Nagle, of Chicago, stated in a communication that a circular had been sent out asking opinions on a proposed new type of pyrometer, in which the water is inclosed in a thin spherical shell and subjected to heat. Is it possible to ascertain temperatures with this device with any sort of accuracy? A general doubt and unbelief was expressed, in the discussion, that success would be had. Prof. Rogers doubted its capacity for ordinary low temperatures as well as for high tempertures.

This ended the paper-reading and discussions and after the passing of the usual complementary resolutions the spring meeting of the American Society of Mechanical Engineers for 1891 adjourned.

But the fun was not over. Rocky Point was still to come. The weather was doubtful, rainy and heavy, but even that did not in the least stop the clambake pilgrimage. When the Bay Queen left her dock she had on board some 475 members, guests and local committee. Arriving at Rocky Point the party found a most excellent lay-out ready for them, and the way it was housed can only be appreciated by those who were present and assisted in the undertaking. The clams were good without doubt, but the sauterne made them most excellent, especially in the northwest corner of the platform.

A souvenir pocketbook, bound in leather, containing a programme of the whole session, and a modest chronological table of the achievements and developments of Providence and vicinity, was presented to each guest during the meal. At the conclusion of the feast the ladies were liberally supplied with bouquets, portions of which were quickly transferred for male adornment.

At 4 o'clock the Bay Queen started with all on board for Newport, where the engineers were treated to an exhibition of submarine torpedo explosions. The explosions were all successful. On the way down to Newport the torpedo boat "Stiletto" amused itself with cavorting after its own individual and special manner around the "Bay Queen" as it traveled southward, to the amusement and admiration of all. The "Bay Queen" did not feel at all disheartened, however, since the same trick had been already played around faster boats, of which the "Mary Powell" is a well recognized instance.

On the return to Providence, the majority of the excursionists landed at the Elm street station of the Narragansett Electric Lighting Station and inspected the plant. The excursion was a success in the broadest sense of the word, and will long be favorably discussed and reminiscences cited by those present.

The morning of Friday, the 19th, was spent in a visit to the works of the Rhode Island Tool Co., the American Ship Windlass Co. and the Corliss Steam Engine Co. At the Corliss works a general blockade was established against all opposition manufacturers, and an additional blockade of certain portions of the shop against the whole company. The Rhode Island Tool Co extended a hearty and highly appreciated hospitality to all. The stages and carriages were detained here so long by a protracted and interesting visit that only a hasty visit could be paid to the works of the Ship Windlass Co.

The last, but by no means the least enjoyable visit, was paid on the afternoon of Friday, the 19th, to Pawtucket and its pumping stations. The stations were visited in succession, and when that tent opposite No. 3 was noted, mouths began so to water, and stomachs to feel so empty, that the water-purveying capacity of the pumps became a secondary matter. Within the tent, finally reached by the anxious party, were found seats for all, and enough to eat and drink for twice the number. After being seated, the company were introduced to the Mayor of the city, who cordially and eloquently extended a hearty welcome to all. The President of the society answered in brief for the society, and the attack on the eatables commenced. With the inner man satisfied, commenced the most brilliant, amusing and effective display of oratory to which the society and its visitors had been favored for the whole session, ending with three hearty cheers and a tiger for the Mayor, the citizens and the "Darling" of Pawtucket. The duties and pleasures of the afternoon being over, carriages, busses and cars were taken to the Pawtucket depot, and Providence was again reached at 5:30 p. m. Thus ended the Spring Meeting of the American Society of Mechanical Engineers of 1891, than which none other has been more highly enjoyed, praised or appreciated. It was the largest of all, most hearty in its local accommodations and receptions, and most regretted when ended.

The only drawback occurring was the inability of the hotels to meet the demands of the large company for the few days of the session. However, the general good feeling established by the apparent ability and generosity of the reception committees, overcame this minor difficulty. At midnight of the 19th very few of the visitors were left in Providence. A goodly party returned by the steamer "Massachusetts" to New York, whence they branched to other cities and directions. The last efforts of the local committees were displayed in the colored fires along the shores of Narragansett Bay on the homeward trip of the "Massachusetts."

Association of Railway Telegraph Superintendents.

The tenth annual meeting of this Association was held at Cincinnati, June 17, President G. T. Williams in the chair. About 75 members and guests were present. Twenty-one new members were elected, many of whom were in attendance. Mr. Charles S. Jones (Illinois Central), Chicago, was elected President, and L. H. Korty, (Union Pacific), Omaha, Vice-President, for the ensuing year. Mr. P. W. Drew, of Chicago, was re-elected Secretary and Treasurer. After the reading and adopting of annual reports an invitation to hold the next meeting at Denver was received from J. J. Burns, of the Denver & Rio Grande, the Mayor of Denver and the Governor of Colorado. General Manager St. John, of the Chicago, Rock Island & Pacific, also sent a letter commendatory of the Association and tendering free transportation to members and ladies. It was then voted unanimously to hold the eleventh meeting at Denver, June 15, 1892. A telegram was received from the Train Dispatchers' Association of America, in session at Toledo, extending congratulations. Messrs. Lingafeld, C. G. Sholes and F. M. Duncan were appointed as a Committee of Arrangements to make preparations for the Denver meeting. Mr. Selden, from the Committee on Topics and Papers, reported that such papers as were ready for presentation would be taken up at the Thursday afternoon session. On motion of Mr. J. B. Stewart it was voted that the annual dues be raised from $3 to $5 after the current year.

THURSDAY'S SESSION.

Mr. S. S. Bogart gave notice that his paper on electric railroads would be forwarded to the Secretary to be printed in the minutes. A communication was received from a school of telegraphy in Minneapolis inviting the co-operation of the Association.

President C. S. Jones then took the chair, and Mr. G. L. Lang, of the New York & New England, read a paper on automatic block signals, which will be found in another column of this paper. It should be said, in justice to Mr. Lang and other speakers, that owing to the disorganization of the committee, caused by the retirement of its Chairman, the members were not called upon to prepare their papers until their arrival at Cincinnati. They consequently were not as complete as they otherwise would have been. In reply to an inquiry regarding damage from lightning, Mr. Lang said that an electrical storm in May burned out seven relays, which were connected with a track circuit, with not more than 10 ft. of line wire. Previous to this storm they had not used lightning arresters for track circuits, but did so now. The form adopted was made of two plates of copper separated by parafined paper.

Mr. M. B. Leonard, of the Chesapeake & Ohio, read a paper on the phonoplex for railroad telegraph lines. He said that the phonoplex, besides increasing the capacity of existing lines, possessed several distinct advantages over the Morse apparatus. Its operation was not affected by the weather. In most instances it would work over a break in the wire where parallel wires existed, the induced current jumping over to the companion wire and thus bridging the break. The phonoplex formed a never-failing means of communication with all offices. The battery now used in connection with it is the Edison-Lalande. On the Chesapeake & Ohio line during the December blizzard all the wires were down between Clifton Forge and Richmond. The phonoplex worked steadily until the other wires were cleared up. The Kansas City, Fort Scott & Memphis road had had a similar experience. He believed that in the Chesapeake & Ohio service the system had paid for itself several times over. In response to an inquiry Mr. Leonard said that in the blizzard the wire was broken, crossed and grounded. They worked through the break by the induced current but could not say which wire it was on. There were four stations between Clifton Forge and Richmond. The operation of the phonoplex could only be stopped by an absolute break where there was no other wire for the current to pass over.

Mr. Robert Stewart inquired if it would work through a leaky wire in a 7-conductor cable a mile in length, if so it would be valuable, as cables were expensive. No positive reply was elicited to this inquiry. Mr. Lang stated that two phonoplex circuits could not be worked on two wires strung on the same set of poles.

Mr. Selden stated that the Baltimore & Ohio has a wire 120 miles long with 30 stations, which it was desired to equip with the phonoplex, but, after several months experimenting, the attempt was abandoned as impracticable. He confirmed Mr. Leonard's statement that it would work over a break under the conditions stated. The Baltimore & Ohio has a set working between Philadelphia and Baltimore, and several sets in New York City. Its longest circuit was 91 miles, but circuits 300 miles long were worked on other roads.

Mr. Lang stated that between Hartford and Boston the phonoplex worked admirably up to within 40 rods of the Boston office, where the wire entered a cable 75 ft. in length which contained a W. U. ticker wire. That made it practically useless.

Mr. U. J. Fry, of the Chicago, Milwaukee & St. Paul, read a paper on the quadruplex. After a brief explanation of the apparatus he referred to various applications which could be made, besides its use between two stations. On his road they have quadruplexed one wire between Chicago and Marion, Ia., 225 miles, and work a single wire from Marion to Omaha, 260 miles, into one side, and another from Marion to Kansas City, 306 miles, into the other side. This enables the Chicago office to work with any or all offices from Marion to Omaha, inclusive. Another wire between Chicago and Milwaukee is quadruplexed. They work a single wire from Milwaukee to Minneapolis, 345 miles on one side, and on the other side is worked a single wire Milwaukee to Prairie du Chien, 200 miles, and to Canton, S. Dak., 300 miles farther, during the night. In the daytime this circuit is disconnected, and that side of the quadruplex is worked duplex. With this arrangement at Milwaukee they are enabled to close some night offices, allowing the wires to work through. The general office at Chicago has access to the entire system through other night offices. With the aid of these combinations and automatic repeaters at junction points they can during the daytime place their General Manager's office in direct communication with any division superintendent's office on the system at very short notice. Two wires run from the telegraph office to the General Manager's office—one to a key and sounder for transmitting, the other to a sounder for receiving, thence to ground; and with the aid of four switches they can extend the local circuits of either quad set down to his office on these two wires. The repeating sounder on No. 2 side, frequently causing trouble, has been dispensed with by putting the reading local circuit in place of the repeating local circuit on the neutral relay. That relay closes the local on the back stop as before; then exchange the tap wire and long end, which places the short end of battery to line with key closed. We give signal on back stroke at distant end, and put the whole battery to line with key open, breaking local at distant end. This change is found very beneficial in working single into quadruplex circuits where it is necessary to keep keys closed, in that when circuits are idle the short end is to line, preventing the heating of rheostat which otherwise would occur to such an extent as to require continual watching. This Mr. Fry believed to be the proper and most economical way of operating a quad. It overcomes the danger of operators who work on both quad and single wires leaving single-wire keys open. This change necessitates closing the key on quadruplex wires as well as single wires, thus rendering the use of keys uniform. Mr. Fry also submitted a plan by which he expects to operate several qualruplex sets from one battery.

Mr. Fry's paper was discussed by several members, among others Mr. Selden of the Baltimore & Ohio, who gave some interesting reminiscences of experiments in 1869 with inventions connected with simultaneous transmission in the same direction.

EXHIBITS.

Thursday at 10 a. m. the Association visited and inspected the various exhibits of electrical apparatus.

The Hall Signal Co. exhibited a working sample of the Stewart-Hall electric train-order signal. This signal was described in the *Railroad Gazette* of Jan. 23 last.

Two "individual calls" were shown, embodying similar principles; one by the Gill Alexander Electric Manufacturing Co., of Kansas City, Mo., represented by Mr. Gill, and the other that of the Electric Secret Service Co., of New York, represented by Mr. S. S. Bogart and Mr. Mackie. The latter system differs from the Gill-Alexander, in the use of an automatic transmitter. The insertion of one of any number of special plugs enables the calling office to secure the attention of any desired distant station by the ringing of a vibrating bell. In the Gill system the regular Morse key is used for sending the required combination, which is an exceedingly simple operation. This was described in the *Railroad Gazette* of March 13 last.

The Union Switch & Signal Co., exhibited a revolving clockwork signal showing danger and safety by semaphores.

The Edison phonoplex system was shown in actual operation over a Chesapeake & Ohio wire. In conjunction with it various types of the Edison-Lalande battery were shown, also condensers manufactured by William Marshall.

A working sample of O'Neil's automatic highway-crossing signal was shown by A. L. Dunbar, General Agent. This was described in the *Railroad Gazette* of July 11, 1890.

I. N. Miller, of Cincinnati, showed a sample of his device for protecting telephone and telegraph instruments against lightning and heavy currents.

W. P. Ward showed a working set of a very simple repeater.

The most interesting exhibit was Dennison's automatic telegraph. It reproduced drawings, autographs, etc., in fac simile in a very satisfactory manner, transmitting and receiving being effected by rapidly vibrating arms across metallic tape at one end and chemically prepared paper at the other. A similar but more perfect reproduction was obtained by the use of an embossed slip.

A Passengers' Brake Valve.

The term "conductor's valve" in connection with a continuous brake obviously has a different meaning on English roads from that which is familiar here, because in that country the conductor or guard confines himself to a single car. Indeed the term is somewhat of a misnomer here, for the reason that the valve is intended for the use of passengers as well as trainmen. A device has been attached to some of the cars of the Manchester, Sheffield & Lincolnshire for the purpose of placing it within the power of any passenger to apply the automatic vacuum brake, which is used on that road, and we understand that it has been adopted for use on all the passenger equipment of that line. It consists essentially of a valve connected with the brake pipe at the end of the car outside, which is operated by means of a vertical rod connected with a transverse rod near the top, the latter in turn being actuated by a longitudinal rod extending alongside the car immediately under the eaves. There is one of these on each side of the car, and it can be turned by means of a chain extending over pulleys to a small crank fixed in a convenient place in each compartment of the car. When the rod is thus turned, a small disc, which normally hangs in a perpendicular position out of sight, is thrown out, so that when the brake is applied from any car the trainmen can, by observing the disc, know in which car it was done. The valve when opened only admits sufficient air to reduce the vacuum from 20 in. to 10 in. The engineer is supposed to then notice what has been done and to stop the train. By the use of the large ejector he can, however, exhaust sufficient air to release the brake and postpone the stop if any emergency should seem to demand such action.

A Railroad to Supplement the Suez Canal.

The Engineer says: "The most important deduction to be obtained from the annual report of M. Ferdinand de Lesseps to the shareholders in the Suez Canal is that the facilities of the waterway are rapidly falling behind the enormous increase of traffic, and that before long probably even the relief afforded by the recent diminution in the time required for transit will be found insufficient. The canal is now being widened by some 36 ft., but this work is not advancing with sufficient speed to afford relief, and the crowding of the canal is so severely felt that the engineers have determined to build a steam tramway between Port Said and Ismailia to carry their own stores, thus displacing the boats and barges at present employed in that service. The road when completed will be at the service of the public for the transportation of passengers and freight."

RAILROAD GAZETTE

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EDITORIAL ANNOUNCEMENTS.

Contributions.—*Subscribers and others will materially assist us in making our news accurate and complete if they will send us early information of events which take place under their observation, such as changes in railroad officers, organizations and changes of companies in their management, particulars as to the business of the letting, progress and completion of contracts for new works or important improvements of old ones, experiments in the construction of roads and machinery and railroads, and suggestions as to its improvement. Discussions of subjects pertaining to* ALL DEPARTMENTS *of railroad business by men practically acquainted with them are especially desired. Officers will oblige us by forwarding early copies of notices of meetings, elections, appointments, and especially annual reports, some notice of all of which will be published.*

Advertisements.—*We wish it distinctly understood that we will entertain no proposition to publish anything in this journal for pay,* EXCEPT IN THE ADVERTISING COLUMNS. *We give in our editorial columns* OUR OWN *opinions, and those only, and in our news columns present only such matter as we consider interesting, and important to our readers. Those who wish to recommend their inventions, machinery, supplies, financial schemes, etc., to our readers can do so fully in our advertising columns, but it is useless to ask us to recommend them editorially, either for money or in consideration of advertising patronage.*

Two collisions occurred this week and two last week, which once more show the need of block signals that exists on most American railroads. Our train-accident record shows only two passengers killed in the last two months (April and May), and those two were perhaps from causes that may be classed as unavoidable, so far as the train service is concerned. It is possible to assume from these favorable monthly records that railroading is surely becoming safer, but we fear such an assumption would be founded on very insufficient evidence. On Sunday a rear collision of freight trains on the New York Central at South Byron blocked all four tracks. While the road was being cleared another train dashed into the derrick car and the wrecker was wrecked, so to speak. The immediate exciting cause of this collision was fog, and it was the same in a butting collision on the Chicago & Alton near Williamsville, Ill., the same day, where a freight train with two engines crashed into an engine and caboose, fatally injuring one engineer and hurting several other trainmen. While, as we have often said, there is ample room for improving the personnel of the train service on most roads, especially in the direction of that branch of discipline which should compel conductors and enginemen to actually as well as theoretically check each other's errors, the simplest remedy for these disasters is the block system. And it is by no means certain that American roads should wait until they can equip their lines with perfect interlocking and blocking appliances before taking *some* action in the matter. Those roads which work under the "single-track block system" find continued satisfaction with it, and, moreover, it provides against butting as well as rear collisions, even when that is not definitely included in the plans.

The two collisions last week both involved passenger trains and caused eight deaths. On the Illinois Central near Sauve, La., a freight train standing on a side track in the night was struck at the front end by a southbound express train running at high speed, and the engineer, fireman, mail clerk and three passengers were killed and half a dozen other men injured. The night was dark, the switch was left wrong and the wreck was a very bad one. The other passenger wreck was at Port Costa, Cal., on the Southern Pacific, where, in broad daylight, a gravel train pulled out onto the main track on the time of a passenger train, when, according to the reports, the conductor and engineer both had just received word that the passenger train was on time and an order giving them leave to start after the passenger train arrived. A brakeman and a mail clerk were killed, and five other men, none of them passengers, were injured. As we have intimated, the moral of these cases is the same as that of the other two, but a circumstance connected with the Port Costa case calls attention to a feature seen on some Eastern roads, the Philadelphia & Reading especially, which to most railroad men seems grimly humorous. The collision occurred on a curve where was located a watch tower "commanding a full view of both ends of the curve." This structure was erected and manned with an attendant "to warn approaching trains of any obstruction on the track"; but, says the reporter, the watchman was removed some time ago on account of the newly introduced economy of the company. We do not know what particular style of "economy" the Southern Pacific uses, and cannot say how much truth there is in this, but it is safe to say that there are at least a hundred other ways in which the wages of that watchman could have been spent to better advantage, and that therefore his removal was good economy. What the reporter means is doubtless that the protection afforded by this watchman, poor as it was, was withdrawn and nothing put in its place. What should be done with such watchmen is of course (after relocating them so that they can conveniently and surely stop trains) to connect them by wire with the nearest other watchman on either side, and thus enable them to give enginemen positive instead of doubtful information as to the safety or non-safety of proceeding. To place watchmen on the hilltops, where they are very conspicuous and very needless in clear weather and out of sight and good for nothing in foggy weather, —when most needed,—is an evidence of a peculiar genius that can hardly be found outside of the railroad service.

Of course most American managers will say that it is wholly out of the question to use a block system on their single-track lines, because they must have trains meet at sidings where there is no telegraph operator, and because freight trains are so numerous that passenger trains would be greatly hindered if compelled to run under a system that protects *all* trains (including freights) with equal security. If only there were plenty of side tracks and plenty of operators to attend them we could, say these men, at once take up this question with practical success. It is true that a system under which slow trains are wholly deprived of all rights which fast trains are bound to respect does, on many roads as they now exist and as they are now run, facilitate the movement of trains better than a block system could do; and the men who do the work are always reluctant to give up any facility, of course. But is it not just possible that the mere question of convenience has had too much weight? Many important movements toward the promotion of safety have been found possible only by decisive action on the part of a manager who, for the time being, resolutely shut his eyes to that question. The protection of trains from collisions ought to be considered from that point of view more than it is. Many a division that now cannot be worked under the block system could be thus worked if so much pains were not taken to make up trains at the hours most convenient to the yardmen and to start them at the hours most convenient to enginemen. While these considerations are not to be permanently disregarded they might profitably be put on the defensive occasionally. The superintendent who determinedly sets out to run his trains so that the fast shall pass the slow ones *always at telegraph stations*, and so that the dispatcher can pursue the same rule in making meeting points for *all* trains, will probably find that by making everything else bend to that one object he can carry out his purpose much better than he expected; and after he has done this awhile he can take a more practical view of the block system.

The railroad telegraph superintendents, whose annual meeting is reported in another column, continue to show good results from their gathering, and although there are hardly enough of them yet to produce the desired enthusiasm it can be said that their Convention amply justifies the time spent. Men who, like these, know enough to talk to the point, and eschew that kind of discussion which Emerson classes with chalk eggs deserve to be encouraged; and Mr. St. John sets a good example for other managers when he tells the telegraphers to compare ideas as often as possible and to thoroughly spread the knowledge thus gained. The paper and discussion on the phonoplex are only one of many indications that there is much practical knowledge on some roads that is greatly needed on others—that many railroad officers are lacking in a kind of knowledge that they can easily obtain if they make a little effort to get it. It is safe to say that many roads could safely give their telegraph department a little more authority to investigate practice and propose improvements. And where a telegraph superintendent is not fit to be thus trusted he should be told to at once make himself fit—or resign.

Railroad Building in 1891.

From the data of railroad building which we have collected and publish in this issue several interesting facts appear. It will be seen first that the construction for the first half of 1891 is less than that of 1890 or 1888, but more than that of 1889. The mileage actually built is larger than most people have supposed it would be, and indicates a fair normal addition to the railroad system of the country during the year, notwithstanding the discouraging outlook at the beginning of the year, and the very cautious attitude which investors still maintain. The figures of miles built for the half-year and whole year are as below:

	Half-year.	Whole year.	Per cent. built in first half.
1888.....	2,980	7,028	42.4
1889.....	1,481	5,751	25.8
1890.....	2,055	5,967	34.4
1891.....	1,610	.....	....

The figures for whole year for 1888 and 1889 have been taken from "Poor's Manual." They are somewhat greater than our own, but as they were published six months later they should be more correct. The total for 1890 is our own; Poor's is not yet made public.

The proportion of the whole building which was done in the first half of 1888 was perhaps abnormally great, for the impetus of the boom year of 1887, when 13,081 miles were built, had not yet died out. The proportion for the first half of 1889 was perhaps abnormally small, because the reaction from 1887 was still felt. However that may be, the mean percentage of the three years is 34.2; and if we assume that in the first half of 1891 34.2 per cent. of the new railroad of the year has been built, the total for the year will be about 4,800 miles. This guess is perhaps as good as another. The situation is one of extraordinary uncertainty. There are many enterprises of old and sound companies that are stopped just between grading and tracklaying, and there are others of new companies stopped at various stages. Any of these would be easily set a-going again. They wait only for a restoration of the confidence of investors. The excellent crops and good prices now promised may bring that confidence very soon; but as every one knows there are unusual complications to bother the speculator and baffle the prophet. Therefore we hazard no guess, for it would be nothing but a guess.

The Southern States still keep the lead which they took some years ago. The following table shows the percentages built in the various large groups of states in the first half-year and the whole year. The groups are the Northern States east of the Mississippi, the Southern States east of the Mississippi, the Southwestern States, including Kansas and Colorado; and the Northwestern and the Pacific Coast states.

		1890.		1889.	
	Half, 1891.	First half.	Year.	First half.	Year.
Southeastern.....	46.7	54	34	45	36
Northeastern	22.5	14	18	17	24
Northwestern....	9.8	10	21	5	10
Southwestern	6.2	16	18	24	18
Pacific.....	14.8	6	9	7	12

One important fact to be noticed is the relatively large percentage of the Northern States east of the Mississippi. This is due principally to the active building in Pennsylvania and Ohio by old companies. In fact, it remains true, as it has been ever since 1887, that the new railroad lines are building by the old companies as feeders to the existing systems. Naturally, it must be largely competitive, but it is not speculative; and even the new competitive lines are quite generally so placed that they will make at least one blade and a half of grass, if not two, grow where only one grew before.

A good deal might be said about the new railroads that have not been built this year, as in the last two years. They have been very often, if not generally, roads that ought not to have been built, and the country will be the better off that their construction has been deferred. Among the influences that have acted to check railroad building the increased wisdom of the public as an investor counts for something; but the determination of the financial powers in Wall street to protect investments already made has been a strong influence also. The results have been disagreeable to promotors, but they have been wholesome. If the new construction of 1891 should fall below 5,000 miles we should not look upon that as an unmitigated misfortune.

The Master Mechanics' Convention.

The Master Mechanics' Convention this year was a success in attendance and fairly so in the reports. There were none so bad as the worst of those presented before the Master Car Builders and none so good as the best; but generally they were prepared with some labor and patience and conscience.

In fact, we suppose that convention reports generally are prepared with a fair amount of conscience.

The committees mean to do their duty. The trouble is that they do not often have any notion of the amount of labor that must go to make a good report. The general idea is that by sending out a circular letter, then collating more or less roughly the opinions gathered, and putting in a thin mucilage of personal knowledge or opinion, the report may be made. It is only when it is too late that the committee learns that there will be few answers to the circulars; that these answers will give mighty little fact, but more guessing; and that there is no royal road to knowledge for a committee any more than for an individual. The consequence is of course that the report is thin. The "epoch-making" reports have always been those into which some men have put their own time and strength.

Of the reports presented this year that which apparently represents the most work is the one on exhaust nozzles, etc. While nothing very new is shown, some useful observations and facts are gathered. The subject is one of extraordinary complexity, and any careful investigation of it is valuable.

Another well-prepared report is that on testing laboratories. We believe that whatever credit is to be given for the report belongs mostly to Mr. Gibbs. The report shows something of the cost of tests and of their value, and is a useful argument in favor of a kind of expenditure that directors and managers of the narrower minded sort are likely to look on as "frills," and are apt to attack first when they start in to economize. In fact, the best paying investment that a railroad company can make is, we believe, a properly organized and run laboratory of tests. It is not a mascot, however. It cannot bring good results unless it is used scientifically.

The report on locomotives for heavy passenger and fast freight service was disappointing. The committee conclude that "the relative economy of ten-wheelers in fast service as against eight-wheel could better be answered in the future than at the present, with the limited actual experience we now have." This is simply dodging. Experience with moguls and ten-wheelers in passenger service is very considerable, as no one knows better than the members of the committee. In fact, it looks as if the committee was chosen because of its special opportunities to see the working of other than eight-wheelers in fast passenger service. The man who has ridden across Canada and Southern Michigan at 60 miles an hour behind Mr. Smart's beautiful ten-wheelers, and has been told over and over again that those machines have realized as much as 50 per cent. saving in fuel, has a right to grumble when he is told that "actual experience is too limited" to enable the committee to even guess at the economy. There are several other points in this report which call for a little attention. The report contains, for example, the following passage:

> We took it for granted that the discussion would be entirely as to the comparative values of the 10-wheel and mogul type when circumstances made it desirable to increase in power and weight beyond the eight-wheel engine. At this point there is a dividing line which, for the service under discussion, nearly annuls the value of the mogul, because the weight as between an 18-in. engine and a 19 in. increases all out of proportion to the increased power, unless this power is obtained by decreasing the size of wheel, which is not desirable for the service named.

Does the committee mean to say that changing the cylinders from 18 in. to 19 in. necessarily increases the weight out of proportion to the increase of power? There is no fixed relation between the weight of the engine and the size of the cylinder—that is, none that is generally recognized. A rule was recommended some time since which has proved to be fallacious and misleading. In the hands of good designers the weight is not the result of the cylinder's dimensions; it is made to suit the load to be hauled and the resistance offered. The boiler is then made as large as possible within this determined weight. The cylinder follows, and is made of sufficient capacity to use economically the steam generated. Thus, for passenger engines working on heavy grades we find larger cylinders than for the same weight of engine on level lines. Not one of the committee would make a stationary engine to run at a 60 or 70 per cent. cut off, but they would make it to work from 25 to 30 per cent. cut-off. So, for heavy grades, they would not recommend a cylinder which would cut off at half-stroke during average service.

The report further says: "For a 20-in. cylinder more weight would be obtained on three pairs of drivers than could be utilized with a 60-in. wheel." This is not true, unless the weight bears in some way a fixed relation to the capacity of the cylinders, which it does not. If a given engine weighs more on three pairs of drivers 60 in. in diameter than a 20-in. cylinder can utilize, why not use a 21 or a 22-in. cylinder? Ordinary mechanical principles would demand it. We note some recent and very successful engines built by the Balwin Locomotive Works for the Baltimore & Ohio, to work on the Piedmont grade. These have 21 × 26-in. cylinders and 62-in. wheels, yet there is not more weight on the drivers than the cylinders can utilize.

In the topical discussion the remarks of Mr. Vauclain on the subject of compound locomotives brought out some very important facts, the substance of which is that, by actual test, compound locomotives have been shown to be better adapted for freight than for passenger service. It was also shown that the largest percentage of saving due to compounding is to be expected from better expansion of the steam rather than from the reduction of cylinder condensation and some other minor evils which are connected with the use of simple locomotives. This again shows that the greatest value of compounding is to be obtained on those engines which are using steam at a late cut off.

On Monday last the New York and Chicago Limited of the New York Central was delayed by a derailment in the Grand Central Station yard and started over two hours late; but after it got started the enginemen apparently "hustled" in a manner only equaled by the gentlemen of the Traffic Department; and as the train was much heavier than most of those with which we are familiar in previous records of high speed, we print below the condensed report of the run, as taken from the train sheet. The engines on the three divisions were all of the same pattern, American type, four drivers, cylinders 19 × 24 in.

SCHEDULE OF TIME MADE BY TRAIN NO. 1 BETWEEN NEW YORK AND BUFFALO. JUNE 22, 1891.

Stations.	Time of—		Late.		Detentions.
	Arrival.	Departure.	h.	m.	
N. Y.—G'nd Cent. Sta..		12:05 p. m.	2	5	2 m. G. C. S. to 130th St. by signals; 5 m. East Albany, drawbridge open.
Albany.....	2:59 p. m.	3:03 p. m.	1	41	
			1	38	4 m. Albany changing engines; 4 m. at Utica taking water.
Syracuse....	6:01 p. m.		1	6	
		6:06 p. m.	1	6	5m. stop and changing engines at Syracuse; 4 m. Rochester making stop.
Buffalo.	9:03 p. m.			25	

	Miles.	Time. Inc. delays.	Time. Exc. delays.	Miles per hour. Inc. delays.	Miles per hour. Exc. delays.
New York to Albany	142.88	2h. 54m.	2h. 47m.	49.27	51.34
Albany to Syracuse.	147.84	3h. 2m.	2h. 54m.	48.74	50.98
Syracuse to Buffalo.	148.80	3h. 2m.	2h. 53m.	49.06	51.61
New York to Buffalo	439.52	8h. 58m.	8h. 34m.	49.02	51.31

MAKEUP OF TRAIN.

New York to Albany—	Eng.	Tender.	Weight, lbs.
Engine 870.....	121,300	80,500	201,800
Buffet car.....			80,000
Compartment car.....			94,500
Section car.....			95,200
Two drawing-room cars, each 83,000 lbs.....			166,000
Dining car.....			80,000
Total (358¾ tons).....			717,500

From Albany to Syracuse the train was hauled by engine 864, and from Syracuse to Buffalo by No. 861. From Syracuse there were only five cars, making the total weight only 317¼ tons.

The trial of the directors of the New York, New Haven & Hartford for misdemeanor in heating passenger-train cars by means of a fire in the cars, contrary to the laws of the State of New York, was begun in the Court of Oyer and Terminer in New York City last Monday, and continued until Wednesday, when Judge Van Brunt directed a verdict of acquittal in the cases of all except President C. P. Clark, and the jury, after four hours' deliberation, acquitted him also. The evidence given at the trial is not very fully reported, but the gist of it seems to be that these directors never took any official action in regard to heating, and that President Clark's action, which led the Court to send his case to the jury while throwing out the others, consisted principally in discussing the merits of heating systems with manufacturers of appliances.

Justice Van Brunt's ruling was, in substance, as follows:

> The cases which have been cited by counsel are those where a principal has been held liable criminally for an act of an agent, which act of an agent has been done within the scope of his authority. A principal is held liable if he actually participates in the act, the agent acting pursuant to authority within the scope of the powers conferred by the principal; and therefore when the principal is held responsible he is not vicariously suffering, but suffering for his own act. Now the position of the defendants under this indictment is entirely different. They are not principals. The New York & New Haven Railroad is the principal. The directors are but the servants and agents of the road. The employés who are employed by them are their coservants, so to speak, and the doctrine of the relation of responsibility to a superior must apply. As far as the employés of the road—and I include within that class the directors—participated in the violation of this statute, they were liable; and when such participation was shown, the question would be for the jury to determine. . . . As to the relation of these directors as individuals with this corporation, the mere fact of their being directors is of no importance whatever. They cannot be held as directors, nor are they indicted as directors.
>
> The question is whether there is any evidence by which the jury could find personal participation or violation of this statute. I think that there is as to one of the directors. There is some slight evidence as against Vice-President Reed, but it does not justify giving it to the jury. The President seems to have participated more closely in the management, and it seems to me that there is evidence to go to the jury as circumstantial evidence that the road was being conducted in that way, by and with his consent, advice, counsel and direction.

The judge charged the jury in part as follows:

> As a matter of law this is a railroad more than 50 miles in length, and it is immaterial whether it has 5 or 45 miles in this state. The running of cars [in passenger trains] within this state with such a system of heating as was used was a violation of the statute. The tunnel accident has nothing whatever to do with this case. The train was not a passenger train, and they had a right to heat it with stoves. If trains heated by stoves were dispatched by and with defendant's [Clark's] authority in violation of law, it is your duty to convict.

Mr. F. J. Sprague has recently published a challenge to the world in which he offers, under certain conditions, to produce an electric locomotive of greater capacity than any that has yet been made. In brief the proposition is to take a train of six standard, elevated railroad cars loaded, weighing with the load and without the motive power about 108 tons; to haul this train at a maximum speed of not less than 40 miles an hour on the level; this to be done on two miles of track of the Second Avenue line, the Suburban Rapid Transit, or the New York & Northern. If Mr. Sprague succeeds the Rapid Transit Commission is to require the successful bidder for the franchise of the new rapid transit route to pay the cost of the experiment "to an amount not exceeding $50,000." Also, any person or newspaper that takes up the challenge "must forfeit a like sum" if Mr. Sprague succeeds. On the other hand, he is to lose the cost of the experiment if it fails. The time is to be four months from the acceptance of this proposal. This, we suppose, must be accepted as evidence that Mr. Sprague is confident that he can do what he says he can, and it will probably have great weight with those people who like to decide things by bets, and who believe that "money talks." We question, however, very much if anybody takes up the challenge. None of the newspapers that have expressed any doubts as to the ability of electric motors to do the work required for the New York rapid transit road have any inducement to go into this sort of enterprise; for it will be observed that the newspaper gains nothing if Mr. Sprague fails, and loses $50,000 if he succeeds. Similarly we see no reason why any railroad company should take this method of getting an electric motor, for it would be a gratuitous payment of $50,000 as a bonus for the production of a motor, and then the railroad would of course have to pay the market price for its electrical equipment. We suspect that an electric motor capable of doing the required work will be developed just as other undertakings are carried out. The men who are going to make money out of it will have to take the financial risk.

A bill is now before the Canadian Parliament to amend the Railway Act by adding provisions to compel passengers to enter cars by the rear platforms and to leave them by the front platforms, and by them alone. Another clause aims at compelling railroad companies to maintain double windows on passenger cars in winter. These are both excellent notions, provided they will work. Railroads ought to see the advantage of retaining the heat in cars, without being told by the lawmakers; and with the very large windows now used the great loss by radiation will doubtless be apparent, even to the less progressive car builders. The Grand Trunk has tried before now to make passengers go in at one end and out at the other, but they refuse to be driven. Perhaps this law is proposed at the instance of the company with a view to renewing the experiment, but it will be of no practical use unless the trainmen are exceedingly alert as well as invariably polite. If they patiently explain the reasons for the improved plan; always see, when one car has empty seats and another has not, that passengers do not go first to the latter and then have to take extra steps to reach the rear door of the other; make exceptions to the rule where there are large numbers to get out and none to get in; and get stationmen to constantly co-operate with them—why, then, a law to bring a gentle pressure on the most obstinate people may do some good. But by the time brakemen become as accomplished as this, passengers will have become too good to jostle each other.

We are glad to see that the poetic spirit is growing among railroad men. There is need enough of it, as will readily be acknowledged by any soulful individual who has to deal with the dry correspondence and other "literary" features of the business. The indication we refer to appears in the passenger department, which has long been far in advance of the rest of us; and it relates to names of trains. The man who nowadays puts on a new train and neglects to give it an entirely new, novel, distinctive, expressive, euphonious, fashionable and taking name has reason to wish he had never been born. But,

sad to say, both of our very nicest roads recently made this very blunder. By some unaccountable blunder their respective stocks of eclat seem to have entirely run out. The Pennsylvania quickly recovered and threw into the waste-basket countless tons of soft matter about the Chicago express in order to place the Columbian Express properly before the world. The New York Central, we are pained to note, was somewhat slower. In fact, its new train, but for fortunate extraneous circumstances, might still be running without any name at all to speak of, and giving its entire energies to its business as a "carrier of persons and property." But fears and doubts are all happily dispelled, and the "World's Fair Special" has now burst upon the gaze of all who are beguiled by brother Daniels' captivating literature. Does any one ask what will become of this name when the Central begins to run a dozen or two World's Fair specials every day? Why, changing the name of a train is one of the most delightful processes known to the advertising department.

NEW PUBLICATIONS.

Summer Resort Literature.—It is unnecessary to tell the readers of the *Railroad Gazette* that the passenger departments of our railroads spend a considerable sum of money yearly in advertising, and that wherever possible the enterprising G. P. A. appropriates a good share of this to showing up the summer resorts reached by his line. The pamphlets issued by the more prominent lines have grown in size and value during the past dozen years, so that now many of them embody the results of a large amount of intelligent and conscientious work. Of the books issued this year several of them are so well filled with carefully arranged tables of routes and well-written descriptive articles of the scenery, hotels and history characteristic of the different localities that they deserve an extended notice. Lacking time and space for this, we append a few notes made from a cursory examination of a score or two of these publications.

The most solid and substantial volume is from what many regard as the most solid and substantial road in the country, the Pennsylvania; and, as is characteristic of the passenger department of that road, the book is also made noteworthy in the opposite direction, that of novelty. This consists of a colored title page showing three young ladies and two dudes riding (apparently from a summer hotel to an afternoon horse trot or tennis game) on the front of a locomotive, where they have to sit very close together. As these people are all dressed in the light habiliments of a summer resort it is presumed that the engineer is running at a very moderate speed. This book is the largest of a score we have received and contains no advertisements. Its descriptions range from Bar Harbor to Los Angeles, and there are numerous illustrations, not without value. Some of them are old woodcuts, and some of the best ones are printed separate from the text referring to them, which impairs their value. There is a good map, made specially for the work, giving the summer resorts special prominence; and the descriptions of the small places and those remote from the Pennsylvania road, are written with as much care, though not at so great length, as those of the more important points. The lists of routes, with excursion rates, are printed in connection with the description of the town or locality in each case.

The Baltimore & Ohio issues a book similar to the Pennsylvania's, but smaller. Its pictures are considerably better, however, and many of them have apparently been engraved especially for the work. The map gives prominence to Virginia battlefields, and there is a special map of Gettysburg. More space is given to rates and less to descriptive matter than in the Pennsylvania work. Like the latter this book gives careful descriptions of Canadian and other resorts remote from the road. Both the above books, though printed this year, are not exactly new.

The New York, Ontario & Western pamphlet entitled "Summer Homes" seems to be a fresh production, and shows its newness by the large number of direct-process cuts made from photographs, of which there are a few in the other books named. This book is confined principally to the resorts in eastern New York State, not far from the line of the road, and gives very carefully written and well-arranged descriptions of the towns, and even tells minutely all about the rooms, the quality of the milk and the society and other features of several hundred farmhouses. There a number of handsome illustrations in colors.

The New York, Lake Erie & Western issues a book which is confined to descriptions of towns and boarding-houses, and another pamphlet is issued giving routes and rates to points off the road, together with some descriptions.

The West Shore issues a handsome book similar to that of the Pennsylvania and quite thick, but on opening it one finds about 50 pages of advertisements of lap-welded boiler tubes, mixed paints and other things that are not particularly interesting when one is starting for a vacation. There are a number of handsome illustrations, evidently made specially for the book, and the front cover is beautiful; but the frontispiece, showing a station restaurant, is calculated to make one feel tired rather than give him an appetite. The inside view of what seems to be a dilapidated barn is also somewhat out of place, even though the artist did faithfully try to get up something picturesque about a ferry-house.

The New England roads have a fertile field in the White Mountains and the numerous ocean resorts, and there are a number of good books, though we notice none with specially new features. The New York, Providence & Boston publishes a good description of the points on its line, with a number of pictures, including some direct-process cuts selected with good taste. The Concord & Montreal shows some very good pictures of the White Mountain region, and also its elegant station buildings at Concord and Nashua. The cut of the latter "gives away" the fact that not all of the old-fogy signals on the road have yet been discarded. There is a very effective folded inset showing a large bird's-eye view of Lake Winnipiseogee. This and other White Mountain guides show maps of some of the villages, indicating the precise location of hotels and boarding-houses.

The Long Island road issues a good book with a number of original and artistic cuts.

"Dollars and Sense" is the title of an 8 × 12 book of 60 pages with the portrait of M. E. Ingalls on the front cover, which suggests the Chesapeake & Ohio Railroad; and on careful inspection the name of that road is found. The book gives a good idea of that portion of the South reached by this route, and it has excellent direct process illustrations, but nearly half of the contents consists of advertisements mixed in among the reading matter.

The Shenandoah Valley issues a little pamphlet consisting of a good running historical sketch of its territory, with illustrations which answer their purpose well, though they are by no means artistic, except in a few instances.

Space forbids reference to numerous books which simply give ticket and route forms. These are valuable in their way, and in one respect are more satisfactory than the more showy publications, because they are compiled with care, while information about scenery and rose-colored historical sketches are sometimes of questionable taste or authenticity. In fact, if the reader finds himself deceived in any measure by this article it will doubtless be because we have not properly criticised the deficiencies in the department just mentioned. As explained at the outset, we cannot take the space to do this here. A certain publication mentions Wachusett as "undeniably the leading mountain resort in New England"; and from past experience we are by no means prepared to say that some of the other books we are mentioning are wholly innocent of such careless statements as this. But the railroads are after all probably better than most other guide-book purveyors, and they are in many respects pioneers; so we are inclined to give them large credit for what they *have* done, rather than magnify their shortcomings; and our criticisms are offered merely as neighborly advice, gratis. Moreover, the railroads have done an immense quantity of this missionary work, at a cost which on the whole is probably moderate. Perhaps the most comprehensive advice to give them is to never sacrifice quality for quantity. A number of roads do their passengers a very good service by making available for them the publications of hotel proprietors and others outside the railroad ranks. This is often a very good way of using a little money and attention.

TRADE CATALOGUES.

Illustrated Catalogue of Greenlee Bros. & Co. Woodworking Machinery. Chicago, Ill.

This pamphlet shows four or five mortisers, as many saw tables, several cut-off machines and other woodworking tools.

Testing Laboratories.

What follows is an abstract of the report of the Master Mechanics' Committee on Testing Laboratories, presented at the Cape May convention:

There are few mechanical officers on railroads who have not felt the necessity of relief from the incessant calls upon their time in reporting upon and deciding questions of a purely scientific nature, or those bearing upon the unfamiliar details of the industries under their charge. In addition to the time consumed is the mental strain induced by the uncertainty of the completeness and accuracy of the information obtained. . . . The needed relief has been sought in the establishment of a scientific and trained practical authority in the systematic treatment of a mechanical subject. The organization and conduction of such a department is possibly one of the most delicate specialties connected with railroad work. . . . Since the investigations required are both chemical and physical, scientific and practical, it will be seen that the chief must be somewhat versed in all its branches. . . . He must be able to plan methods of testing and experimenting, and see that they are properly carried out. . . .

Your committee believe that much valuable time has been frittered away at times in testing laboratories by the practice of taking up work which would, of necessity, not give satisfactory practical results, or which, when obtained, are insignificant in value to that of the time wasted in arriving at them . . . A list of the subjects which can, in our opinion, be profitably undertaken, and which will produce results of practical value, embraces: First, routine physical and chemical work, such as is indicated in the appendix, testing shipments of material kept in stock regularly and bought under definite requirements. Second, special work, such as tests of the efficiency of machines, fuels, improvements in mechanical construction and patented devices, trials of water purification, tie preservation methods and others. . . .

The first matter of importance which will engage the attention of the head of such a department is establishing standard specifications for material bought regularly and in quantity. . . . A specification as applied to "materials" may be defined as a concise statement of certain peculiar qualities which make such material safe and valuable for certain uses. . . . We strive to ascertain by quick methods of test the qualities developed ordinarily only in the course of time; in other words, substituting indirect tests for direct. In so doing there is obviously danger that we may really fail to identify a material completely from a recognition of one of its qualities only. To make the point clear by example: A satisfactory material for locomotive staybolts is commonly stated in specifications as one having a tensile strength of 50,000 pounds per the square inch and an elongation in such test of 28 per cent., with the additional provisions that it shall be cut with a good thread and have its fracture free from lamination. A good quality of well-worked muck-bar iron will fill these conditions, and so will many grades of "mild steel"; but the latter material will appear from results obtained in the testing machine so vastly superior in uniformity and the exceptional combination of high strength with great ductility, that, on the sole assumption of rigid adherence to the conditions specified, an expert would not fail to predict superior practical results from the steel. In point of fact, we know that so far steel has proved a complete and absolute failure for staybolt purposes. It is therefore manifest that our specifications are likewise a failure, unless limited to call for iron. We have neglected some important practical feature, some quality possessed by iron and not developed yet in steel. . . .

In general the first aim in framing specifications should be to obtain completely the requisite standard for quality, neither more nor less, and in so doing to encroach as little as possible upon the freedom of the purchasing department in obtaining as wide a market as practicable to buy in. These tests for establishing quality may be drawn from various sources, and should where possible be from actual service. Having found the qualities of importance from a service point of view, these must be brought out by laboratory tests of such a nature that they can be duplicated under exact conditions each time, and be quick, handy and cheap. . . . In buying under specifications, the purchasing agent should maintain a close consulting relation with the testing department as to the uniformity and reliability of the material from different manufacturers. The head of such a department keeping a close watch of the behavior of the material under test and under all conditions of manufacture and use, should be able to draw valuable generalized conclusions to be obtained in no other way. . . .

As to the attitude of manufacturers toward the department, our inquiries among a considerable number of the larger and better class, many of whom themselves pursue systematic methods of testing, lead us to believe that they are very much in favor of such departments properly conducted; one reason being the protection given them against unprincipled dealers by putting all upon a level.

As to the very important question, whether such a department increases the cost of supplies to railways, opinions differ somewhat. Your committee believes, after careful inquiry and considerable experience, the cost may be very slightly increased, but not to an appreciable extent to that which at first might be expected.

Among the tendencies toward lowering the cost are:

1st. Manufacturers have, when selling to meet specifications, definite knowledge of how the quality of their material will be ascertained by the purchaser, and they do not have to make allowances for uncertainties in this respect. . . .

2d. The cost of material is not proportionately increased with a bettering of the quality, on account of the constant effort of manufacturers to meet demands for improved qualities by introducing cheaper processes.

3d. In many instances much less costly material is bought under specifications than under the old practice, where fancy prices have been paid for material which was above the necessary requirements in quality and yet formerly justified where uncertainty was not permissible.

The only well defined tendency toward increasing cost is in establishing a perfectly reliable standard of quality. It will be conceded that a certain standard for quality is necessary for safety and a well organized department establishes only the necessary grade. On the score of safety to life and property, therefore, the results to be obtained in this way from a testing department would seem to constitute one of its most valid claims to our consideration.

Another of the benefits is that through them manufacturers have become better acquainted with the requirements of railroad practice and have been brought to modify their methods to meet requirements, and that with the least increase of cost consistent with the requisite quality. A close watch from year to year upon the variations in the character of material received through a testing laboratory is convincing testimony to the truth of this statement.

Plan of Organization.—The two branches before mentioned should be in charge, respectively, of a specialist who may be called the "engineer of tests" and the "chemist"; these men should report to a general head of the department, the superintendent. . . .

The numerical force of a fully equipped department on one of the larger systems of the country may comprise:

One superintendent, one chemist and one assistant, one foreman of testroom and two assistants, two general assistants to the superintendent, for special experimental work and inspection of material at a distance, A portion of the force in each branch may usually be young men who have had good technical educations, and who are willing to spend some time in the laboratory for the practical training they will get and at a nominal salary. In fact, the testing laboratory provides a very valuable school for training young men for usefulness in other departments.

Equipment and Cost.—What follows under this head is considered to apply to one of the larger systems of railroads of the country. Your Committee decided not to submit drawing of plans for a laboratory, as such drawings could only be based on an ideal case, which might be found unnecessarily expensive for many. In many railroad shops a good building, partially used for other purposes, is at hand, and may be made readily available, the requisites being sufficient room and light; water and gas for the chemical, and power for the physical laboratory. In designing the chemical laboratory, the best but not absolutely essential arrangement, should contemplate separate apartments for various classes of manipulations. A moderately costly plan would embody a general, or main laboratory, of about 500 sq. ft. area, containing hoods for fume work, evaporating baths, sinks and work benches, the whole piped conveniently for water, gas and steam; an oil testing room of 100 sq. ft., with fire-proof floor and hood; a balance room and office of 200 sq. ft., a photometric and photographic dark room of 150 sq. ft., and a store-room of 100 sq. ft.; or a floor-space in all of 1,100 sq. ft., say, 22 × 50 ft.

The cost of such a laboratory, exclusive of building and partitions, will be as follows:

Apparatus—weighing balance, glass and platinum ware, etc	$400
Chemicals	200
Total	$600
If photometer and photographic apparatus be added	150
Total	$750
Cost of special benches, hoods, furniture and gas, steam and water connection will vary, but average	400
Total for fitting up and equipping laboratory	$1,150

The plan of the physical laboratory may be of a simpler character, comprising a general testroom, 20 × 40 ft., 800 sq. ft. area, and a small office 12 × 15 ft., 180 sq. ft. area. The testroom must contain power shafting, either from main engine of shops or from a special motor, for running machines, and a vise and workbench. The least amount of equipment considered by your committee satisfactory is as follows:

A 200,000-lb. screw power vertical tensile testing machine, arranged to take tensile specimens up to 4 ft. in length and transverse and compression tests of any desired length; a screw power machine of same type as the above of 50,000 lbs. capacity, to be used in light work where the heavy parts of the larger machine impair accuracy and consume time in handling; an hydraulic spring-testing machine of 60,000 lbs. capacity, with registering apparatus, scalebeam for weighing stress, and weighted arm to test quality of motion when desired; an axle drop-testing machine arranged for testing axles and springs, a car-wheel drop-testing machine. A friction oil-testing machine would be a valuable adjunct, if one could be had which would give results under conditions comparable with those of practice, or even results under certain ideal conditions, if these results could be always duplicated by different observers at different times. Your committee know no machine on the market which properly fulfills these conditions. For the miscellaneous outfit is needed a set of United States Standard male and female gauges, both screw and blank, up to two inches diameter, and a set of staybolt tap gauges; a Vernier micrometer gauge for taking sections, and a set of scales and machinists' tools. For special work of an experimental character, varied equipment would be needed, suited to the circumstances; this equipment would embody a steam-engine indicator and rigging, apparatus for boiler tests, dynamometer car, etc. Some roads have followed the practice of having the testroom prepare the specimens, and have provided a small machine shop, with lathes and planers for same. This practice, while it has some advantages, does not seem to your committee generally warranted, when the general machine shop is at hand and can be conveniently and economically drawn upon for machine work when needed. The cost of apparatus for a physical laboratory would be according to the above list:

200,000-lb. tensile machine	$2,350
50,000-lb. tensile machine	750
60,000-lb. spring tester	720
Axle drop tester	250
Steam engine indicator	70
Wheel drop tester	100
Standard gauges	200
Micrometer gauges	40
Scales and tools	20
Shafting and belts	150
Total	$4,650

In addition to the equipment and room above provided for, the superintendent of the department should have an office, which besides the usual fittings should contain a cabinet for storing specimens of various materials and parts of machines which have shown abnormal results in practice or defects in structure; also a good working library of scientific and technical books and periodicals. . . .

Committee, { GEORGE GIBBS, DAVID L. BARNES, GEO. W. WEST, L. S. RANDOLPH.

Appendix.

Under this head your committee have grouped extracts from letters received from heads of the mechanical departments of railroads having testing laboratories, manufacturers of railroad material and others. No general circular letter was sent out, but information was requested from those who had had experience, or who had come into contact with testing work. Interesting letters of reply were received in this way from the mechanical departments of several foreign railroads, for which your committee wish to express their obligations. The replies received from English railways show that the Lancashire & Yorkshire, the London & Northwestern and the Midland Railroads have established extensive testing laboratories, and the mechanical officers speak in high terms of their usefulness.

G. W. Rhodes, Supt. M. P., C., B. & Q.—Our experience of the effect of laboratories on the price and market of railroad supplies is, that they diminish the cost to the railroad company of its material, and enables them to take advantage of a comprehensive and intelligent selection of goods without regard to the price or the reputation of the manufacturers. We have reduced the price of our steel boiler plate very materially by means of the laboratory, and the quality of our oils, fats and paints also has much improved. In conclusion, we regard a laboratory as a very necessary adjunct to any large railroad. It is also very desirable to have a certain number of special men employed; these men may not always be actively employed, but it is just as necessary to have them as it is to have a wreck master and his outfit. Men of this type are employed in railroad service, and there is no more useful place for them to carry on their particular line of work and investigation than the laboratory. We would recommend that the extra men that are usually carried in the engineering department, the transportation department and elsewhere be placed in the laboratory, to be drawn from there when their services are required in other branches of the service.

J. N. Barr, Supt. M. P., C., M. & St. P.—I am decidedly of the opinion that the testing laboratory has come to stay, that the results so far are very encouraging, and that we may expect still more decided results in the future. I am of the opinion that the effect of a well-conducted laboratory would be to increase the price of railroad material. I take this ground because I am of the opinion that much railroad material today is really too cheap to be good, or to be economical for a railroad to use.

L. B. Paxon, Supt. M. P. & R. E., Philadelphia & Reading.—As a rule, we have noticed but little effect on the prices of railroad materials, the fairness of our specifications and competition preventing an advance. In some few cases there has been a small increase in the first cost, but this has not been in proportion to the improvement in the quality of the material obtained. There has been an undoubted improvemen in the service given by those materials which are now bought on specifications and uniformly tested.

Prof. J. B. Johnson, of Washington University.—Probably the greatest advance to be made in the next half century in engineering will come through a better knowledge of the nature of engineering materials and the way stresses act upon and affect them. There are hundreds of unsolved problems in railroad operations, many of which could be run down and solved in a testing labratory provided it is managed on scientific principles, and not as an office or shop, where only certain standard tests of a rude nature are carried out under fixed instructions by half-educated employés

N. K. Fairbanks & Co. say in reply to a question as to the effect of a well-conducted laboratory on the price and market of railroad material: "This question must be answered with the assumption that the test to which the materials will be subjected is practical and not theoretical. It is well to have ideals, but specifications must not idealize the purchasing agent out of the market We believe that proper tests properly conducted by railroad companies are highly to be commended for the following reasons: First, they insure the road the economy arising from the use of good material; second, they put all manufacturers on the same level before the purchasing agent; third, if railroads require goods of a high standard of quality, manufacturers can be found who will meet the standard. Of course higher prices will be charged, but the goods will be worth more. Competition between manufacturers will keep prices within proper bounds, and the tests conducted by the railroads will show whether they can pay the advanced prices for better goods or not."

Pencoyd Iron Works.—We believe the greatest benefits to be derived by the establishment of proper tests and inspection by railroad companies of all classes of material, which we believe to prevent improper competition and insure to the purchaser a much better quality of article without any increase whatever in cost. We also believe a thorough inspection and test by the purchaser to be a great safeguard to the manufacturer desiring to place upon the market a thoroughly reliable product.

Schoenberger & Co.—We feel certain that the establishment of tests by railroad companies will be of great benefit to the consumer of structural material, as well as to the conscientious producer of such. Strict and careful examination will necessarily be connected with expenses, and the cost of production being considerably increased, the price of such material may be slightly higher than that of material made with less care. For our part, we greatly prefer to furnish our locomotive steel to companies making thorough chemical and physical tests of it.

TABLE A.

SUMMARIES OF TESTS IN LABORATORIES OF C., M. & ST. P.

Physical.

Materials.	1888. Per cent. rejected.	1889. Per cent. rejected.	1890. Amount received.	1890. Per cent. rejected.	Cost of tests.
Axles	2½	6	5,927 axles	5.3	68c. per 100.
Angle bars	4	.....	.....	.....	.....
Bar iron	2⅜	4	4,772 tons	3.9	11.2c. per ton.
Boiler tubes	17	8⅜	6,991 tubes	7.2	16.4c. per 100.
Chain	0	4	50 tons	3.7	10c. per ton.
Links and pins	3	30	722 "	9.8	6.0c. per ton.
Springs—helical	2¾	00	20,573 spr'gs	15.2	40c. per 100.
Springs—elliptic	14	7	1,839 "	0.6	$1.50 per 100.
Steel plate	4	3	956 plates	7.2	23.4 each.
Track bolts	00	00	5,053 kegs	3.8	92c per 100 kegs
" spikes	00	00	14,235 kegs	15.5	16c. per 100 kegs
Wire—barbed fence	00	14	6,388 reels	00	8c per 100 reels.
Turnbuckles	.....	.....	1,260 pc's	00	10c. per 100 reels
Taps, dies and reamers	.....	.....	284 "	5	$3 per 100.
Chemical.					
Antimony	0	.....	29 casks	0	
Lead and tin	0	0	1,599 pigs	0	
Wire—barbed fence	0	0	6,438 reels	0	
Spring—helical	3.33	9 69	20,573 spr'gs	14.48	
Oil—lard	0	0	405 bbls.	0	
" —linseed	0	0	780 bbls.	0	
" —headlight	6.78	0	8,850 bbls.	12.64	
" —miln seal	23.21	8	1,651 bbls.	7.27	
" —valve	0	6	1,040 bbls.	0	
" —Turpentine	0	0	78 bbls.	0	
Soap—toilet	0	.....	116 gross	0	
Soda—caustic	0	0	87 drums	0	
Soda ash	0	0	141 bbls.	0	
Water	.....	0	40 samp's	.....	

Total number of analyses in 1890, 589, representing 1,829 determinations of elements. Season 1890 not favorable for water analysis.

NOTE.—Rejections of material which were tested, both chemically and physically, are charged in this table to the department in which requirements failed to be filled, thus for springs the physical rejections are in addition to the chemical

TABLE B.

SUMMARY OF PHYSICAL TESTS, LABORATORY B. & O. R. R., FISCAL YEAR 1889-90.

Materials.	No. of tests.	Quantity represented.	Accepted.	Rejected.
Axles, steel	104	3,856	3,257	599
Boiler, steel	1,089	807,352 lbs.	771,051	36,301 lbs.
Cast iron	126	General foundry use.	.....	.....
" " wheels, 33 in	806	40,522	39,591	941
" " " 31 in	71	3,032	3,017	5
" " " 30 in	8	488	488	.....
" " " 28 in	2	101	101	.....
" " " 26 in	9	531	526	5
" " " 24 in	4	205	205	.....
Chain	476	214,114 lbs.	175,513 lbs.	38,601 lbs.
Coupling links	33	3,750	3,750	.....
Steel forgings, crank pins, parallel rods, etc	47	95,378 lbs.	93,678 lbs.	1,700 lbs.
Springs, helical	1,071	16,350	15,281	1,069 lbs.
" elliptic	762	762	756	6
" engine	1,675	1,675	1,657	18
Stay bolt iron	70	69,727	60,042	9,685
Splice bars	55	74,795 prs	74,795 prs	.....
Tire steel	192	548,268 lbs	539,748 lbs.	8 520 lbs.
Wrought iron, merchant bar	2,332	7,660,508 lbs.	2,194,313 lbs.	2,466,195 lbs.
Wrought iron, merchant bar, accepted without test account of urgency	.....	.....	5,194,343	180,578 lbs.

EXPERIMENTAL TESTS.

Material.	No. tests.	Remarks.
Axle, broken driving	5	
Axle, broken engine truck	2	
Boiler iron	5	Exploded boiler.
Brasses	28	
Coupling links	6	
Cast iron	6	Broken wheel.
Side rods	6	Engine 824.

DISCUSSION.

Mr. FORNEY: In the hands of experienced and proper persons a laboratory is of great advantage to railroad companies and manufacturers. In the hands of inexperienced persons there results a waste of money. I think that the success of a mechanical laboratory depends entirely upon the ability and the clearheadedness of the man who is in charge of it, and if a laboratory was created by the Association I think it is extremely doubtful whether the person selected would have the necessary qualifications. The fact is that the capacity for careful observation in the minds of most people is so defective that in making experiments they do not see actually what does occur. They are also very rarely able to reason correctly on what they observe.

I never knew any person to find out anything about a locomotive from an indicator, that was worth knowing.

Mr. VAUCLAIN: I have found out a good many things about locomotives from the indicator.

Mr. HICKEY: This Association can't afford to go on record that nothing is to be learned by the use of the indicator on the locomotives.

Mr. CLOUD: I have indicated locomotives a great many times, and I learned a good deal. The very fact that some of these gentlemen have never used an indicator on a locomotive is only an evidence in my mind that the general practice has been advanced and made good by somebody else's indications. Not only have I learned some thing of the better operation of locomotives from indicators, but I have got information which was useful, and have used it to convince other men, who were running engines, how they should run them.

We are confronted with the compound-engine question. It has only been developed along the proper lines by the proper use of the indicator, and it will only be advanced without unnecessary expenditure of money by the continued use of the indicator.

Mr. MEEHAN: I could tell Mr. Forney several things that I found out with the indicators.

Mr. LEWIS: I have learned something from the indicator, and rise in defense of it. The indicator is a photograph of the work that the engine is doing.

Mr. BARNES: It is waste of time to discuss such an elementary matter as the indicator. It seems to me that is quite foreign to this report. There are some matters here that are of importance; for instance, you will notice that 7⅛ per cent. of boiler material is thrown out, and in another case 15½ per cent. of track spikes were rejected. If that does not show the value of a laboratory, I don't know what does. During the past year several laboratories have been discontinued, and there has been a general reduction in laboratory force throughout this country. This is the situation which should be discussed, particularly when it is shown by this report that it costs but 24 cents per plate to test boiler material and but 16 per cent. per hundred kegs for spikes, and other parts in proportion.

A Decision on Steam-Heating Patents.

On June 6 a decision was reached by the U. S. Patent Office in the interference suit of Searle v. Shackleton v. Magee v. Shinn v. Frost v. Baker v. Wilder v. Walworth & Upton v. McElroy v. Gold v. Towne, where the following applications for patents on car heaters were in interference: Searle, filed March 23, 1888; Shackleton, filed Dec. 22, 1887; Magee, filed Dec. 15, 1887; Shinn, filed Sept. 2, 1887; Frost, filed April 22, 1887; Baker, filed April 11, 1887; Wilder, filed April 1, 1887; Walworth & Upton, filed March 16, 1887; McElroy, filed March 10, 1887; Gold, filed March 9, 1887; Towne, filed Feb. 4, 1887.

The issue in controversy is defined as follows:

"1. The combination with a car of a system of circulating pipes within said car and two heaters, both in operative contact with said circulating system, or with branches thereof, and adapted to be operated simultaneously or separately for imparting heat thereto.

"2. In a car-heating system, the combination with a system of water-circulating pipes within the car of a suitable radiator in contact with said circulating system, or a branch thereof, mechanism for supplying said radiator with steam as a primary means of heating said circulating system, and a secondary heater also in operative contact with said circulating system and adapted to heat the same."

This case as originally declared included the joint application of T. A. Bissell and E. A. Benson, 268,468, and also the sole application of C. E. Dolan, 251,533.

The examiner says: "In the first place, the term 'car' and 'car heating system,' as used in the issues, must be held to comprehend a building that is either stationary or movable, otherwise the application of Shackleton would have no place in this interference; for in it he neither describes, illustrates or claims a heating device for a *car*, in the sense in which the term is ordinarily used, his whole device being shown as only adapted to heat a house or stationary building. The first issue defines a system of circulating pipes with two heaters in operative contact with such system and adapted to be operated simultaneously or separately for imparting heat to the system. The second issue demands that the system shall consist of pipes that circulate water, a radiator in contact with the system, steam as a primary means for heating, and a secondary heater in operative contact with the system and adapted to heat the same.

"As the examiner understands these issues, the first may employ any fluid within the circulating pipes; it must employ two heaters which shall be in *operative*, as distinguished from *direct*, contact with such fluid, and these heaters must be so arranged that they may act and be used separately and independent of each other, and at pleasure may be both brought jointly into active co-operation. As to the second, he understands that the contents of the circulating pipes shall be limited to water; that there shall be a radiator in contact with the pipes, with mechanism for supplying such radiator with steam as a *primary* means for heating, and a second heater in operative contact with the pipes, and this without reference to the heaters acting simultaneously or separately.

"McElroy's alleged date is the summer of 1883. The testimony presented by him discloses that in July, 1880, he was appointed superintendent of the Michigan Institute for the Blind; that while occupying this position the legislature made an appropriation for the erection of a building to be occupied as a residence by the superintendent; that during its construction he devised a means for heating it which included the use of steam from the engine-house of the main building in connection with the ordinary type of hot water heater as an auxiliary heater. He introduces a sketch. The evidence discloses that in January, 1885, a construction similar to that shown in the sketch was placed—at the expense of the institution—in a portion of the superintendent's residence for the purpose of furnishing heat to the kitchen and to rooms connected with it as well as to

furnishing a supply of water for the kitchen and wash-stands in the building, the first heating apparatus placed in it being confined to that part which included only the parlor, sitting and dining-room and several bedrooms, and that such apparatus was used and operated up to the time he left the institution in 1887, and, for aught that has been shown to the contrary, has been in use ever since.

"The examiner has little hesitancy in arriving at the conclusion that the apparatus so constructed and used is a full reduction to practice of each of the issues. In view of such a conclusion, it is unnecessary to consider the testimony presented by Wilder, Towne, Gold or Shinn, for the earliest date of conception that any of them alleges is December, 1886, such date being claimed by Wilder. Prior to such date Baker had conceived, built and publicly used a construction such as the first issue defines, and McElroy had done the same thing as to both issues.

"Shackleton and Magee being limited to their application dates, and Baker having conceived and reduced to practice the construction defined in the first issue before McElroy had a conception of it, it is apparent that as to such issue he should be considered the first inventor. As Baker has been considered as never having reduced to practice the second issue, his earliest conception will not avail him, and McElroy should be held as the first inventor of the second issue.

"Judgment of priority of invention as to the first issue is awarded to W. C. Baker, and as to the second issue a like judgment is awarded to James F. McElroy. Limit of appeal will expire June 26, 1891.

"The earliest application of any of the contesting parties is that of Towne, Feb. 4, 1887; the applications of Baker and of McElroy being filed on April 11, 1887, and March 10, 1887, respectively. It is believed that the testimony as above outlined has established the fact that the construction defined in each of the issues has been in public use for more than two years prior to the date upon which either the application of Baker or of McElroy had been filed, and that a statutory bar exists against the grant of a patent to either of them. The attention of the Commissioner is respectfully directed to this conclusion."

The Rivers at Johnstown, Pa.

The Board of Trade of the City of Johnstown, Pa., was stirred to action regarding the liability of the city to inundation during every freshet in the Conemaugh River and its tributaries, Stony Creek and the Little Conemaugh, by a flood which occurred on Feb. 17 last, when a large portion of the city was overflowed.

Under the leadership of Mr. A. J. Moham, the energetic Vice-President of the Johnstown Street Rail Company, it was wisely decided that the first step to be taken was to have a comprehensive examination and report made by a civil engineer, showing the exact conditions of the rivers and the sources of possible danger. For this work they selected Mr. J. J. R. Croes, M. Am. Soc. C. E., and his report was presented to the committee on June 15.

It comprised a full description of the dams and reservoirs on the tributary streams, the river channels in Johnstown, the topography of the city and the causes of liability to flooding, accompanied by maps, profiles and photographic views of all points of interest, prepared for the report. The conclusions reached are thus summarized:

The only possible source of danger to that portion of Johnstown south of the bridge from any structures existing on the streams tributary to Stony Creek and the Little Conemaugh rivers, is the washing down of logs stored in the Lumber Company's dam at the mouth of Shade Creek by the breaking away of the splash dam on Clear Shade Creek. In view of the possibility of such an event occurring, it is desirable that provision should be made in the splash dam for the overflow of the water of freshets through a spillway, which can be readily constructed in that part of the dam which is now made of sheet piling only. The rest of the dam should be raised three feet and the cribs filled with stone

To that portion of Johnstown north of the stone bridge, which was formerly known as Morellville, there is a possibility of disaster from the failure of the sawmill dam and the St. Clair dam on Mill Run. Neither of the dams on this stream can be looked upon as safe.

As regards the rivers within the city limits, the inundation of that part of Johnstown south of the Little Conemaugh in floods such as (from experiences of 1887, 1889 and 1891) may be expected every second year, is caused almost entirely by the contraction of the channel of Stony Creek between the south end of Market street and the point where the Valley Pike strikes the river, about a thousand feet below the Baltimore & Ohio railroad bridge. The contraction of the river between these points produces the raising of the water surface above the Franklin street bridge to such height as to overflow both the east and west banks, and flood Meadowvale, Kernville and Johnstown.

The obstructions which have been placed in the way of a full discharge of the water of the Conemaugh River, below the mouth of the Little Conemaugh, do not appear to have ever raised the water above the mouth of the Little Conemaugh to such a height as to overflow the city between Stony Creek and the Little Conemaugh to any great extent. The main volume of water has come into the town over the river banks east and south of Franklin street.

The obstructions to the flow of the Conemaugh River are caused, first, by the piers of the Pennsylvania Railroad bridge; secondly, by the contraction of the water way below the bridge by deposit of material from the iron works.

The raising of the water in the greatest floods which are recorded below the mouth of the Little Conemaugh has been such as to injure the Cambria Iron Company by flooding their works, but has not been such as to injuriously affect the city of Johnstown south of Walnut street. The water of the great freshets below the bridge has always risen over the lands west of the stream, and the raising of the surface of the ground there to admit of the construction of buildings has not been great enough to prevent such flooding; and the only remedy for this state of affairs is to raise the whole surface of the ground which has been occupied, taking care to leave in addition to that a sufficient channel for the stream, that is, a channel having 5,000 square feet of waterway.

As regards the stone bridge of the Pennsylvania Railroad, experience has shown that the five openings of the stone bridge which are in the waterway of the river are insufficient to pass the water of the greatest floods recorded, but that the water rose 7 ft. over the east bank and flowed through the two openings which are used for travel. It is desirable to lower this flood water at least 2.5 ft., so as to make the surface slope of the stream uniform through the city, and this can be accomplished by the clearing out of six of the openings between the piers.

If Iron street is to be permitted to remain in its present position, it would be possible to construct another opening to the west of the present west abutment of the bridge, and this would afford sufficient waterway for any freshet which has so far occurred, but would not afford room enough for the passage of such a freshet as may occur, judging from the experience of other similar streams. Such a freshet would probably raise the water nearly 5 ft. higher at the bridge and back the water of Stony Creek up to Poplar street, making it at Franklin street bridge about the same height as the flood of June 7, 1887.

This is the worst that could be expected, and no damage to Johnstown could result from it, provided that at all points along the line of the stream, from one end of the city to the other, where the natural surface of the bank is below the assumed flood level, as indicated on the profiles and plans, the banks of the river be protected by dikes carried up to a proper height above the assumed maximum level, and such height should range from 5 ft. at the stone bridge to 2 ft. at the Baltimore & Ohio Railroad bridge at station 248.

With the channel widened, and, where necessary, deepened in the manner indicated on the plans and profiles, and hereinbefore recommended, I believe that the great and ever-imminent danger to Johnstown from being inundated by the water at Stony Creek flowing into the city over its banks between the Baltimore & Ohio Railroad bridge and the Franklin street bridge, may be permanently averted. Without the rectification of the channel between these points, such danger will always exist.

The report, with all the maps and illustrations, will be published as soon as practicable, and will be for sale by the author and at the offices of the technical journals in New York City.

The New Era Grader.

Those who are not familiar with the New Era grader will be interested in the following concise description of the machine, the various kinds of work it will do and the saving of expense on work for which it is adapted:

The machine consists of a strongly trussed frame, 14 ft. long by 8 ft. wide, mounted on broad, low wheels ratcheted on steel axles. A small but strong plow attached to a beam and connected by a drawbar and chain to the front axle, and regulated as to height and depth by a gauge wheel and chains running to pilot wheels, is carried on the left side where the operator can regulate the depth desired to plow. From the mold-board side of the plow, running to the right and upward, is a strong carrying belt, which by means of gearing from the rear axle is kept running at right angles with the course of the machine. This carrier is arranged in sections, so that the earth may be delivered 14, 17, 19 or 22 ft. from the plow, and the apron is a heavy, three-ply, rubber belt, 3 ft. wide. This carrier is hung by chains attached by shafts operated by hand wheels, so the operator can regulate the height of delivery.

The machine is drawn usually by 12 horses, although steam or other motive power may be used. As the machine moves forward, the operator lowers the plow into the earth and starts the carrier gear. The dirt as raised by the plow and turned to the side falls upon the belt and is rapidly carried to the side and deposited in embankment, or in wagons when the desired delivery is beyond the reach of the carrier.

When earth can be taken from each side of a desired embankment the machine will build embankments for railroads, levees or country turnpikes to the extent of from 1,000 to 1,500 cu. yds. in 10 hours' work, with 3 men and 12 horses as an operating force. Railroad embankments 16 ft. wide on top and 4 ft. high, levee embankments 4 ft. wide on top and 6 ft. high or canals 5 ft. deep and 30 ft. wide are readily built direct by the "New Era" at the daily rate mentioned, so the cost per yard for such work can be determined on the basis of daily wages for the working force specified, and which varies in different localities.

The Austin dump wagon built for use with the grader receives its load and makes delivery at such height or distance as may be desired. Three of these wagons will receive and deliver the earth from the grader on a lead of 100 ft. Wagons are thus loaded at a cost of from 2 to 3 cents per cubic yard, and hauling any given distance can be readily computed by estimating the speed of working teams at 200 ft. per minute.

Whenever the earth is quite free from large roots or stones that would impede the plow, and with solid footing for horses, this plant will, it is claimed, handle earth on such work as railroad or levee embankments, country roads, cutting down hills, excavation of reservoirs, or earth moving in general at from 30 to 70 per cent. of the cost of such work as it is ordinarily done.

TECHNICAL.

Manufacturing and Business.

The plant of the Kansas City Car & Wheel Co., at Birmingham, near Kansas City, which has been closed since last February, will be opened up early in July by the Missouri Car and Foundry Co., of St. Louis.

Riehle Bros., of Philadelphia, have separated their scale and testing machine business, and these branches will hereafter be carried on by two distinct companies. The former will be the Riehle Bros.' Scale Co., and will be located at northwest corner Twenty-fourth and Filbert streets, and the latter will be the Riehle Bros.' Testing Machine Co., located at 413 Market street, Philadelphia.

The Muskegon Car Works, of Muskegon, Mich., which have been closed for two months, are about to be reopened. The creditors have decided to capitalize the debts, amounting to about $130,000, and reorganize on the basis of $250,000.

The Cleveland Wheelbarrow & Manufacturing Co., of Cleveland, O., has purchased the business of the Cleveland Wheelbarrow & Truck Co. The transfer will not affect the business in any way, the only change being the retirement of Mr. E. F. Wright, who has been succeeded by Mr. J. W. Hornsey as Secretary and Treasurer. The company has prepared a new catalogue of contractors' tools.

The Rail Market.

Steel Rails.—The market continues dull, and little activity is expected during July. An order for 2,000 tons to an Eastern mill was the largest placed during the week. The quotations are: At New York $30.75@$31; at Chicago, $31@$32, and at Pittsburgh $30 at mill.

Old Rails.—Old iron rails have sold at Pittsburgh for $22.50@$23. Old steel rails are quoted at $17.50@$18.30. At Chicago old iron rails are quoted at $23 and old steel rails at $14.50@$16.50, according to length.

The Pickering Spring Company.

While at Cape May several of the Master Car Builders and the Master Mechanics received an invitation to visit the works of the Pickering Steel Spring Company, located at Eighteenth street and Pennsylvania avenue, Philadelphia, Pa., and examine the improvements in buildings and plant, the method of manufacture, tempering and testing their springs, as well as the quality of work produced and the amount of material used and of springs turned out. The chairman of the company, Mr. Frank S. Layng, received the visitors and showed them around.

The building is some 200 ft. long by 80 ft. in width, having a reception room in the northeast corner. A machine shop, 50 × 40 ft., and the regular offices of the company, are on the second floor. The basement and cellars are used for the storage of fuel, petroleum and tempering oils. Since Mr. Layng became Chairman of the company great progress and improvement have been made. As a whole, the shops present the most approved combination of modern appliances for spring manufacturing purposes. The extent of the work may be appreciated when it is known that the company turn out some 20 tons of springs per day of all kinds and classes used for railroad purposes. At the time the visitors were at the works, there were ten carloads of locomotive springs ready for shipment to the southwest. A large stock of material is kept on hand at all times ready for working up to fill orders. Petroleum is used for furnace purposes, thereby eliminating sulphurous effects. The shops are lighted by electricity after the Westinghouse plan, with over 100 lamps in use. Every spring, before shipping, is thoroughly tested, both for quality and capacity, and besides the physical capacity of the material being tested, the chemical combinations contained are also kept sight of, so that the springs shall be kept up to the highest demands of present standards.

The Buffalo Electric Disk Wheels.

The admitted popularity of electricity as an operating medium, is becoming so great that it is called for and adopted wherever possible. The Buffalo Forge Co., of Buffalo, N. Y., has just perfected and introduced an electric fan wheel which can readily be applied in any location. The motors are built in as part of the structure, and the whole calls for but little power for operation. To start the fan requires merely the adjustment of a switch or the pushing of a button. The electric current for moving the fans can be obtained at little cost from any of the electric light or power companies in reach. The fans are carefully mounted and balanced, and are guaranteed to run quietly at high speeds. The motors are of the latest approved construction, and are capable of continuous use without close attention. The fans are of the same construction as already described, and regularly placed on the market by the Buffalo Forge Co.

The American Continuous Drawbar.

The draft and buffing apparatus of the American Continuous Drawbar Company has been specified for 100 coal cars contracted for by the Vandalia line and 500 cars for the Choctaw Coal & Railway Company. The Illinois Central Railroad Company has purchased a license to use the device on their entire equipment.

New Boats for the Hoboken Ferry.

The Hoboken Ferry Co. (the New York connection of the Delaware, Lackawanna & Western Railroad) is building two new ferry-boats. They will be screw boats, on the same principle as the Bergen, which was illustrated in the *Railroad Gazette* Aug. 9, 1889, having a screw at each end. They will be 19 ft. longer over all (that is, 222 ft.), with more beam on hull but the same over guards. They will be double-decked. Their engines will be compound instead of triple expansion. They will each have two high-pressure cylinders 20 in. diameter, and two low-pressure cylinders 36 in. diameter, with a stroke of 28 in. They will have an independent pumping engine to drive the air and circulating pumps; the heating will be done by forced circulation, as in the Bergen. The boilers are of mild steel, 9 ft. diameter, 21 ft. long. There will be a central division in the cabins of the same general style as in the Bergen, but longer in order to accommodate the companionways connecting the upper and lower cabins. The style of decoration will be somewhat similar to the Bergen's. The boats will be named "Hamburg" and "Bremen."

New Stonington Ships.

The Harlan & Hollingsworth Co. has contracted to build two duplicate steel propeller steamers, each 310 ft. long, for the Providence & Stonington Steamship Co., for service on Long Island Sound. Both will be finished by May 1 next. They will cost in the neighborhood of $750,000 each.

Car-Heating Patents.

The Safety Car Heating & Lighting Co. has issued a circular from which the following is an extract: "The question before the Patent Office for some years past has been as to the priority of the invention of heating railroad cars by certain methods of construction. The recent determination of the Examiner of Interferences, after declaring Baker and McElroy prior inventors, was 'that the testimony has established the fact that the construction defined in each of the issues has been in public use for more than two years prior to the date upon which the application either of Baker or McElroy had been filed, and that a statutory bar exists against the grant of a patent to either of them.' This conclusion es-

tablishes the fact that the use of such methods is public property, and does not affect the apparatus used by us. All apparatus placed on cars by this company is fully covered by patents held by us, and we will protect purchasers of our apparatus if notified of and allowed the defense of any suit or proceedings affecting the same. An appeal will be taken."

THE SCRAP HEAP.

Notes.

Press dispatches report wholesale discharges of conductors on the Illinois Central in Tennessee and in Iowa.

The locomotive engineers and firemen of the East Tennessee, Virginia & Georgia have secured a readjustment of wages, which is said to give them a considerable increase.

President M. E. Ingalls, of the "Big Four" and Chesapeake & Ohio systems, who is about to take a vacation in Europe, gave a dinner to 40 of his subordinate officers at his house in Cincinnati last week.

Kilburn J. Brown, a sleeping-car conductor between Montreal and Boston, has been arrested for smuggling goods into the United States by concealing them in the pillow boxes of his car. It is said that the frauds have been very extensive, and one account states that cases have been brought against him in the courts before.

"Railroad Legislation Continues without Abatement in Michigan." This is the heading of a dispatch in the New York *Herald* last week, and it aptly summarizes the subject. The number and variety of measures under discussion in relation to railroad charters, taxes, etc., is so great that a succinct statement of affairs cannot be made until the end of the session, which appears still to be in the dim future.

In the United States Circuit Court at Brownsville, Tex., last week two of the train wreckers who robbed a train on the Rio Grande road last winter were tried and sentenced, one of them to imprisonment for life and the other for 10 years. The mitigation of the last sentence was in consequence of evidence that the man tried to back out of the plot, but was intimidated by threats of assassination.

On Friday night of last week the Wheeling & Lake Erie road was submerged between Oreville and Creston, O., stopping all trains. The same night, on the Pittsburgh, Fort Wayne & Chicago, three bridges across Sippis Creek were carried away. A cyclone at Cairo, Ill., Sunday blew cars off the tracks, and did much other damage. On Anderson's Run, near Leechburg, Pa., June 18, the water rose 30 ft., and floating débris displaced a railroad bridge. John Frank fell from the bridge as it went down, and was fatally injured. Several small bridges of the Lake Erie & Western between Crandall and Farmdale, Ill., were destroyed on the night of June 17 by a cloudburst which flooded Farm River Valley. Five other bridges were crippled, and several trains had narrow escapes. The Fort Worth & Denver, which resumed business June 14, after 10 days' suspension on account of floods in the Red River Valley, was again stopped on the 16th, the rains being renewed and the river becoming more ungovernable than ever. Two more bridges were carried away, and 30 miles of track were more or less washed.

The Nicaragua Canal.

At the annual meeting of the Nicaragua Canal Construction Co. held on Thursday last at Denver, Colo., the following directors were elected: Warner Miller, Stuyvesant Fish, W. Seward Webb, Samuel Thomas, Gordon McDonald, J. F. O'Shaughnessy, J. W. Miller, Henry R. Hoyt, H. B. Slaven, Smith M. Weed, Geo. W. Davis, all of New York, and N. K. Fairbank, of Chicago, and H. A. Parr, of Baltimore. The new directors are Messrs. Fish, Webb, Thomas and McDonald, who take the places of R. Sturgis, A. M. Hoyt, R. A. Lancaster and J. L. Macauley. There were 90,000 shares voted out of 105,000 shares issued.

Atchison Employes Must Not Run in Debt.

The officers of the Atchison, Topeka & Santa Fe have, like many others, had no little trouble with writs of garnishment issued against employés, and the General Manager has finally issued the following order:

"The number of garnishment suits against our employés is constantly on the increase. These suits result in trouble and expense to the paymaster's department, and interfere with our employés properly attending to their duties. While the railroad company recognizes that such suits are evidence of distress upon the part of a few of it employés, it has nevertheless been decided to put a check upon the present unreasonable number of garnishments.

"All employés are therefore notified by this circular that, commencing with July 1, 1891, garnishment to exceed three times within any 12 months will be considered sufficient cause for discharge, notwithstanding the ability or length of service of the employé.

"No exemption will be made from this rule except where it is clearly demonstrated to the General Manager that the number of garnishments is the result of persecution.

"It is earnestly hoped that this order will result in the discharge of no employé, and to that end the General Manager suggests that employés who are in arrears frankly state their condition to their creditors and endeavor to arrange by the payment of their indebtedness in agreed installments to avoid garnishment suits."

Inducements for Travelers.

We notice that a folder of the Chicago, St. Paul, Minneapolis & Omaha Railway, recently issued by the passenger department, makes a special point of the Pintsch gas for lighting the cars of that road. When the G. P. A. begins to boom an appliance he outherods Herod, and in this case there is no qualification in the phrase which the "Omaha" man gives to the Pintsch light. The Central of New Jersey also, in a little pamphlet entitled "Why Not Own Your Own Home on the Line of the Central Railroad of New Jersey?" publishes what purports to be a voluntary testimonial from the commuters on that road. If this is a "sure enough" expression of the opinion of those commuters they beat any of the class that we ever had any experience with. We venture to say that it is the first time in the history of commuters that they have deliberately and voluntarily praised the railroad on which they travel. These New Jersey commuters after speaking of the superior train service, and, most wonderful to say, of the uniform courtesy of the trainmen, refer particularly to the lighting of the coaches, and say that the gas furnishes a brilliant, clear illumination which enables them to read in any part of the car.

A Pass Fraud.

Mr. L. R. Gordon, General Superintendent of the Michoacan & Pacific Railroad of Mexico, writes us that during his recent absence in this country his chief clerk, Charles A. Sponogle, has written letters to secure passes from some 50 American railroads, evidently intending to use them by impersonating Mr. Gordon. He is also carrying a letter of recommendation to which Mr. Gordon's signature is forged. His attempt to steal $3,000 from the company was the occasion of the discovery here announced. Sponogle hails from San Francisco, Cal., and is 27 years old. He has light complexion and a light mustache; weighs 140 lbs., and is 5 ft. 8½ in. high. He speaks Spanish.

Canadian Railroad and Canal Expenditures.

The sums for railroads and canals which the Dominion Minister of Finance will ask Parliament to vote this session, chargeable to capital account, according to the estimates just laid before the House, are as follows, comparison being made with the appropriation of last year:

	1890-91.	1891-92.
Canadian Pacific	$ 24,900	$ 50,100
Intercolonial	187,100	358,000
Cape Breton	50,000	130,000
Oxford & New Glasgow	30,000	5,000
Eastern Extension	3,500	.....
Prince Edward Island	.....	45,000
Montreal & European Short Line	101,000	.....
Canals	4,884,000	3,232,000
Total	$5,280,500	$3,820,100

Of the expenditure on canals, $78,750 is for the Welland, $15,000 is for a turning basin in the Kaministiqua River, and $115,000 to complete the graving dock at Kingston, Ont.

A Dreadful Chestnut.

When Gen. Lew Wallace succeeded Governor Axtell, of New Mexico, a few years ago, the latter shipped a carload of Mexican products and curios from Albuquerque to Cleveland, O. The lot included specimens of Mexican furniture, household utensils, etc. The Governor also sent as a gift to his grandchildren two burros. When the car reached its destination the freight agent in checking off the freight noted the receipt of all the articles enumerated except the "two burros." So he reported thus:

Agent, Albuquerque.—Car 2,916, consignee Axtell, Albuquerque to Cleveland, May 9, short two bureaus, over two jackasses. Please advise.

JONES, Agent, Cleveland.

This answer is said to have straightened out the matter very satisfactorily:

Agent, Cleveland—Change places with the jackasses.

SMITH, Agent, Albuquerque.

—*Chicago Mail.*

Tramps Capture a Train.

As a southbound freight train on the Louisville Division of the Pennsylvania was leaving Indianapolis on the morning of June 6 it was boarded at the belt crossing by 23 tramps, who, when ordered off, overpowered the trainmen and ran the train to suit themselves. Officers were notified by wire, and attacked the outlaws at Columbus, Ind. The tramps had congregated in a box car, and when the officers attempted to raid it they were met with a volley of shots, which they immediately returned. After maneuvering for some time the tramps were routed from the car and the officers succeeded in securing nine of them.

The northbound passenger train on the same line was bulldozed by a drunken mob near Seymour at 9 p. m. the same day. Knives were drawn and used freely. Charles Cuttinger was badly used up, as were also two strangers. Four men were arrested.

Obscure Joke Picked up in a Freight House.

Two of a trade can never agree. Workmen can't even roll barrels of flour without a little falling out.—*Puck.*

Impression Gained by Reading the Newspapers.

"A Massachusetts lady remarked to a member of the family of President Clark, of the New York, New Haven & Hartford road, 'I see that Mr. Clark's road is in trouble in New York.' Mr. Clark's relative said yes. 'Well,' said this good woman, 'I am awful glad that he had nothing to do with it, but that Chauncey Depew was the man who is responsible for the whole business.'"
—*Story told by Mr. Depew.*

LOCOMOTIVE BUILDING.

The South Bound road has placed an order for eight locomotives with the Baldwin Locomotive Works.

The Toledo, St. Louis & Kansas City has let an order for building 20 locomotives to the Rhode Island Locomotive Works, of Providence.

CAR BUILDING.

The Savannah, Americus & Montgomery will probably soon let orders for building 500 freight cars, for which bids have been recently asked.

The Toledo, St. Louis & Kansas City has awarded a contract for building 500 box cars to the Michigan Car Co., of Detroit.

The Roanoke Machine Works has an order for 100 platform cars for the Norfolk & Western. Work will begin on these as soon as the order of box cars now being built is completed.

The Southern Pacific has recently added 600 freight cars, including box, furniture and fruit cars, to its equipment.

BRIDGE BUILDING.

Bay City, Mich.—The Bridge Commission has decided to advertise for bids for the construction of a new bridge across the west channel of the Saginaw River at Twenty-third street. Although the bonds have not yet been sold, the councils of the Bay Cities have authorized the commission to go ahead with the preliminary work. The new span will be of iron and steel. A bridge is also to be erected at Belinda street at a cost of $60,000.

Des Moines, Ia.—It has been decided to erect a bridge 32 ft. wide and 400 ft. long over the Coon River at Ninth street, in Des Moines.

Dunlow, W. Va.—The county court of Wayne County, W. Va., has decided to build a new bridge across Twelve Pole River at Dunlow. The bridge will be 200 feet long, with single span, plate girders and stone foundations.

Great Falls, Mont.—The Wrought-Iron Bridge Co., of Canton, O., has been awarded the contract for erecting a bridge at Fifteenth street, Great Falls, for $35,000.

Hardy County, W. Va.—Last week the commissioners of the County of Hardy, W. Va., let the contracts for building the masonry of three new county bridges. One over Buzzard's Ford was let to Robert Oates at $5.50 a perch, the bridge to be of steel and the abutments to be of dressed stone. The masonry of the bridge over the Capon River was let to John Wood at $4 a perch. The one over Lost River was let to Jacob Matthias at $4.50. All these bridges are to be of steel. The contracts for the superstructures have not been let.

Houston, Tex.—The bridge on the main line of the International & Great Northern, over Buffalo Bayou, at Houston, Tex., is being replaced with a new iron structure.

Lumberton, N. J.—A new iron bridge is to be erected at this place by the County Commissioners.

Milwaukee, Wis.—The Milwaukee & Wauwatosa Motor Line Railroad has awarded the contract for building a viaduct about 2,300 ft. long to Keepers & Wynkoop, of Milwaukee, Wis., for $76,666. The work is to be completed by Nov. 1 next.

Nebraska City, Neb.—The Burlington & Missouri highway bridge at Nebraska City, was opened June 17. The structure cost about $40,000 and is the only highway bridge across the Missouri between St. Joseph and Omaha.

Peoria, Ill.—The Board of Supervisors have let the contract for the new iron bridge in Timber Township, to the King Iron Bridge & Manufacturing Co., of Cleveland, O., for $1,022.

Pittsburgh, Pa.—The contract for the masonry for the new suspension bridge to be erected over the Allegheny River between Pittsburgh and Allegheny has been let to the Drake & Stratton Co., Limited, of Pittsburgh, and it is to be completed by December next. The cost of the masonry, which will consist of one pier in the centre of the river and abutments at each side, will be $88,300, and the superstructure it is estimated will cost about $500,000. The bridge will have four tracks, two for street cars and two for wagon traffic. The foot passages, one on each side, will be 10 ft. wide.

Richmond, Va.—The Mayor has signed the ordinance granting the privilege of constructing an iron viadact on First street to make connection with Barton Heights.

Sioux City, Ia.—The Iowa & Nebraska Bridge Co., recently organized for the purpose of building a railroad, wagon and footbridge over the Missouri River at Sioux City, will at the next meeting of the council ask for the right of way leading from the bridge site to the terminal company's grounds.

Utica, N. Y.—The West Shore is preparing plans for a bridge at Lansing street in East Utica.

RAIL ROAD LAW—NOTES OF DECISIONS.

Powers, Liabilities and Regulation of Railroads.

In Pennsylvania a decree for the judicial sale of a railroad declared that "any purchaser . . . shall take . . . subject to all unpaid purchase money for any of the lands or rights of way herein referred to, as well as also all unpaid claims of land owners for damages for property taken, injured or destroyed in the construction of the railroad." The Supreme Court holds that the purchasing company was not liable upon a judgment rendered prior to the sale against the old company for a trespass in entering upon plaintiff's land and constructing its road without leave, especially when it appeared that after obtaining the judgment, plaintiff had granted a right of way to the old company.[1]

The Court of Appeals of Kentucky decides that the statute providing that where a railroad has been given its right of way free of charge it shall be fenced at the entire cost of the company, after notice from the adjoining land owner that the fence must be built, is unconstitutional, in that it delegates to such land owner the authority to determine whether a fence is necessary, which is a police power, and also discriminates in his favor.

In New York the plaintiff attempted under the general railroad act of 1850 to acquire land for building an elevated railroad 15 miles long, passing through the site of solid blocks of buildings in the City of New York, upon which express trains of the largest passenger capacity might run at great speed, the road to be constructed in the form of a two-story viaduct, the first being about 50 ft. wide and about 60 ft. above the street level, and the second being above the first, with the same centre line, 22 ft. wide on top and 75 ft. above the street, each having two tracks and consisting mainly of brick arches through the blocks, and crossing the streets by steel bridges. The Court of Appeal holds that the act confers no power to build such a railroad and that the statute of 1880 prohibiting the building of any railroad "in, upon, or along any of the streets or avenues of the City of New York," applies to and prohibits the building of a railroad across the streets of that city.[3]

In Massachusetts a statute consolidating two corporations provided that the new corporation should "be subject to all the duties, restrictions, obligations, debts and liabilities to which, at the time of the union, either of said corporations is subject," and that "all claims and contracts . . . . against either corporation may be enforced by suit or action . . . against the" new corporation. The consolidation was made on the basis of equality between the shares of the two corporations. Plaintiffs held bonds, issued by one of the corporatioss, convertible into its stock on completion of its road. The Supreme Federal Court decides that they were entitled to demand stock in the new corporation, as for the purposes of this contract the old corporation continued under the new name.[4]

The New York Court of Appeals holds that the statute of 1869, c. 917, §5, authorizing the consolidation of railroad companies, and providing that all debts and liabilities of either company, except mortgages, shall attach to the new corporation, and be enforced against it and its property to the same extent as if created by it, allow an action against the new company on bonds and coupons of one of the former companies, though they are secured by a mortgage on the property of the original debtor corporation.[5]

In the Federal Court it is decided that a contract be-

[1] Campbell v. Pittsburgh & W. R. Co. (Pa.), 20 A., 949.
[2] Ohio & M. Ry. Co. v. Todd, 15 S. W. Rep., 56
[3] People's Rapid Transit Co., v. Dash, 26 N. E. Rep., 25.
[4] India Mut. Ins. Co. v. Worcester, N. & R. R. Co., 25 N. E. Rep., 975.
[5] Polhemus v. Fitchburg R. Co., 26 N. E. Rep., 31.

tween railroad companies by which one company allows the other to use its freight depot and tracks in consideration of rent at a fixed rate per ton and per car, without any provision as to the length of time the contract is to remain in force, may be rescinded by either party at any time on reasonable notice.[6]

[6] Chattanooga, R. & C. R. Co. v. C., N. O. & T. P. Ry. Co., 44 Fed. Rep., 456.

MEETINGS AND ANNOUNCEMENTS.

Dividends.

Dividends on the capital stocks of railroad companies have been declared as follows:

Baltimore & Ohio, semi-annual, 3 per cent. on the preferred stock.

Boston, Revere Beach & Lynn, semi-annual, 3½ per cent., payable July 1.

Chicago, R ck Island & Pacific, $0.50 per share, payable August 1.

Chicago, St. Paul, Minneapolis & Omaha, semi-annual, 2 per cent. on the preferred stock, payable July 20.

Fitchburg, 1½ per cent. on the preferred stock, payable July 15.

Missouri Pacific, quarterly, 1 per cent., payable July 15.

New York Central & Hudson River, quarterly, 1 per cent., payable July 15.

Oregon Railway & Navigation Co., quarterly, 1½ per cent., payable July 1.

Norwich & Worcester, semi-annual, 4 per cent., payable July 6.

Richmond, Fredericksburg & Potomac, semi-annual, 3½ per cent., payable July 1.

Rio Grande Western, quarterly, 1¼ per cent., in cash, on the preferred stock, payable August 1.

Tennessee Coal, Iron & Railroad Co., semi-annual, 4 per cent. on the preferred stock, payable July 15.

Stockholders' Meetings.

Meetings of the stockholders of railroad companies will be held as follows:

Alabama Midland, annual, Montgomery, Ala., July 15.

Chicago Junction Railways & Union Stock Yards Co., annual, Chicago, Ill., July 2.

Cincinnati & Westwood, special, 5 United Bank Building, Cincinnati, O., July 3, to consider a proposed increase of the capital stock.

Duluth, South Shore & Atlantic, annual, Marquette, Mich., July 16.

Hudson Tunnel, special, Mills Building, New York City, June 30, to consider a proposed issue of bonds.

Marquette, Houghton & Ontonagon, annual, Marquette, Mich., July 16.

Mineral Range, annual, Hancock, Mich., July 14.

Mobile & Girard, annual, Girard, Ala., July 1.

New York & Massachusetts, annual, Poughkeepsie, N. Y., July 14.

Savannah, Americus & Montgomery, annual, Americus, Ga., July 9.

Suffolk & Carolina, special, Suffolk, Va., July 9.

Technical Meetings.

Meetings and conventions of railroad associations and technical societies will be held as follows:

The *New England Railroad Club* meets at its rooms in the United States Hotel, Beach street, Boston, on the second Wednesday of each month, except June, July and August.

The *Western Railway Club* holds regular meetings on the third Tuesday in each month, except June, July and August, at the rooms of the Central Traffic Association in the Rookery Building, Chicago, at 2 p. m.

The *New York Railroad Club* meets at its rooms, in the Gilsey House, New York City, at 2 p. m., on the third Thursday in each month.

The *Southern Railway Club* holds regular meetings on the third Thursday of the months of January, February, March, May, September and November at such points as are selected at each meeting.

The *Central Railway Club* meets at the Hotel Iroquois, Buffalo, the fourth Wednesday of January, March, May, September and November.

The *Northwest Railroad Club* meets on the first Saturday of each month, except June, July and August, in the St. Paul Union Station, at 7:30 p. m.

The *Northwestern Track and Bridge Association* meets on the Friday following the second Wednesday of each month at 7:30 p. m. in the directors' room of the St. Paul Union Station, except in the months of July and August.

The *American Society of Civil Engineers* holds its regular meetings on the first and third Wednesday in each month, at the House of the Society, 127 East Twenty-third street New York

The *Boston Society of Civil Engineers* holds its regular meetings at the American House, Boston, at 7:30 p. m. on the third Wednesday in each month.

The *Western Society of Engineers* holds its regular meetings at 78 La Salle street, Chicago, at 8 p. m., on the first Wednesday in each month.

The *Engineers' Club of St. Louis* holds regular meetings in the club's room, Laclede Building, corner Fourth and Olive streets, St. Louis, on the first and third Wednesdays in each month.

The *Engineers' Club of Philadelphia* holds regular meetings at the House of the Club, 1,122 Girard street, Philadelphia, on the first and third Saturday of each month, excepting in January, when the annual meeting is held on the second Saturday of the month. The second January meeting is held on the third Saturday. The club stands adjourned during the months of July, August and September.

The *Engineers' Society of Western Pennsylvania* holds regular meetings on the third Tuesday in each month, at 7:30 p. m., at its rooms in the Thaw Mansion, Fifth street, Pittsburgh, Pa.

The *Engineers' Club of Cincinnati* holds its regular meetings at 8 p. m. on the third Thursday of each month in the rooms of the Literary Club, No. 24 West Fourth street, Cincinnati.

The *Civil Engineers' Club of Cleveland* holds regular meetings on the second Tuesday of each month, at 8 p. m., in the Case Library Building, Cleveland. Semi-monthly meetings are held on the fourth Tuesday of the month.

The *Engineers' Club of Kansas City* meets in Room 200, Baird Building, Kansas City, Mo., on the second Monday in each month.

The *Engineering Association of the South* holds its monthly meetings on the second Thursdays at 8 p. m. The Association headquarters are at Nos. 63 and 64 Baxter Court, Nashville, Tenn.

The *Denver Society of Civil Engineers and Architects* holds regular meetings at 36 Jacobson Block, Denver, on the second and fourth Tuesday of each month, at 8 o'clock p. m., except during June, July and August, when they are held on the second Tuesday only.

The *Civil Engineers' Society of St. Paul* meets at St. Paul, Minn., on the first Monday in each month.

The *Montana Society of Civil Engineers* meets at Helena, Mont., at 7:30 p. m., on the third Saturday in each month.

The *Civil Engineers' Association of Kansas* hold regular meetings at Wichita on the second Wednesday of each month at 7:30 p. m.

The *American Society of Swedish Engineers* holds meetings at the club house, 250 Union street, Brooklyn, N. Y., and at 347 North Ninth street, Philadelphia, on the first Saturday of erch month.

The *Engineers' Club of Minneapolis* meets the first Thursday of each month in the Public Library Building, Minneapolis, Minn.

The *Canadian Society of Civil Engineers* holds regular meetings at iss rooms, 112 Mansfield street, Montreal, P. Que., every alternate Thursday except during the months of June, July, August and September.

The *Technical Society of the Pacific Coast* holds regular meetings at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., at 8 p. m. on the first Friday of each month.

The *Association of Civil Engineers of Dallas* meets at 803 Commerce street, Dallas, Tex., on the first Friday of each month at 4 o'clock p. m.

The *Montana Society of Civil Engineers* meets at Helena, Mont., at 7:30 p. m., on the third Saturday in each month.

The *Civil Engineers' Association of Kansas* holds regular meetings at Wichita on the second Wednesday of each month, at 7:30 p. m.

The *American Society of Swedish Engineers* holds meetings at the club house, 250 Union street, Brooklyn, N. Y., and at 347 North Ninth street, Philadelphia, on the first Saturday of each month.

The *Engineers' Club of Minneapolis* meets the first Thursday of each month in the Public Library Building, Minneapolis, Minn.

The *Canadian Society of Civil Engineers* holds regular meetings at its rooms, 112 Mansfield street, Montreal, P. Que., every alternate Thursday except during the months of June, July, August and September.

The *Technical Society of the Pacific Coast* holds regular meetings at its rooms in the Academy of Sciences Building, 819 Market street, San Francisco, Cal., at 8 p. m. on the first Friday of each month.

Railroad Telegraphers.

The Grand Division of Railway Telegraphers held its annual meeting at St. Louis last week, and elected A. D. Thurston Grand Chief Telegrapher; S. O. Fox, Grand Secretary and Treasurer. The negotiations for a union with the Brotherhood (commercial operators) failed because of a clause in the by-laws of the railroad order requiring a three-years service as a qualification for membership. The brotherhood thinks one year is enough.

PERSONAL.

—Mr. Edward Ellis has been elected President of the Schenectady Locomotive Works, vice Mr. C. G. Ellis, deceased. Mr. Wm. Ellis has also been elected Treasurer.

—Mr. J. F. Boyd, Superintendent of the Cumberland Valley road, was this week appointed Superintendent of the Mont Alto Railroad, to succeed the late Colonel George D. Wiestling.

—General Manager George F. Evans, General Passenger Agent Joseph S. Odlorne and General Freight Agent L. S. Parsons, of the Louisville, Evansville & St. Louis, have resigned, to take effect July 1.

—Mr. E. T. Horn, Superintendent of the central division of the St. Louis, Iron Mountain & Southern at Little Rock, has resigned to accept a position with the Murphy & Pierson Railroad Contracting Co.

—Mr. A. G. Wells, Superintendent of the Peoria Division of the Cleveland, Cincinnati, Chicago & St. Louis, which is to be operated independently of the main line, will, it is reported, be transferred to the Indianapolis & Galion Division.

—Mr. C. C. Martin, the Chief Engineer and Superintendent of the New York and Brooklyn Bridge, has been elected President of the Rensselaer Polytechnic Institute, at Troy. Mr. Martin is a graduate of the institute in the class of '56. He is elected to fill the vacancy caused by the resignation of Mr. David M. Greene, who has been at the head of the institution for the last 13 years.

—Mr. William H. Truesdale, President and Receiver of the Minneapolis & St. Louis, has resigned those positions. He has been President and General Manager of the road for the last five years, and when it became insolvent in the fall of 1889 he was chosen Receiver by the conflicting interests. Mr. Truesdale is about 40 years old, and has been in railroad service since 1870.

—Mr. T. G. Shaughnessy has been elected a Director and Vice-President of the Canadian Pacific, succeeding as director Mr. J. J. C. Abbott, the new Premier of the Dominion of Canada. Mr. Shaughnessy has been in the service of the Canadian Pacific for the last eight years, and has been Assistant General Manager since 1885. He was elected Assistant President in September, 1889.

ELECTIONS AND APPOINTMENTS.

Atlantic & Danville.—C. W. Murdaugh has been appointed Purchasing Agent of this road.

Burlington & Missouri River.—Robert Balance has been appointed General Foreman of Car Repairs at Denver, Colo., vice Warren Fuller, resigned.

Boston & Maine.—P. N. Chase, of Great Falls, N. H., has been appointed New England Agent of the road, with office at Boston, to succeed J. C. Miles, resigned.

Canadian Pacific.—At a meeting of the directors held last week the resignation of the Hon. J. J. C. Abbott as Director of the company was accepted, and T. G. Shaughnessy was elected in his place. Mr. Shaughnessy was also elected Vice-President.

Cape Fear & Yadkin Valley.—The Directors have elected W. A. Lash President of this company, to fill the vacancy caused by the death of the late Julius A. Gray.

Carolina Midland.—The stockholders of the company organized a short time ago by the consolidation of the Blackville, Alston & Newberry and the Barnwell roads, held a meeting at Blackville, S. C., June 17, at which the following officers were elected: President, George A. Wagener; Superintendent, J. Keys; Treasurer, Mike Brown; Directors, George A. Wagener, A. S. J. Perry, Simon Brown, H. Brewer and D. H. Salley.

Charleston, Glendening & Sutton.—At a meeting of the stockholders of this road held in Charleston, W. Va., last week, the following directors were elected: F. W. Abney, J. Q. Dickinson, A. L. Ruffner, C. C. Lewis, E. L. Butterick, J. D. Baines, E. W. Wilson, Malcolm Jackson, C. C. Watts, John B Floyd, Frank Woodman, W. A. MacCorkle and W. F. Goshorn. The directors organized by electing F. W. Abney President, John B. Floyd Secretary, and J. D. Baines, Treasurer. The executive committee is composed of Messrs. Malcolm Jackson, J. B. Floyd and C. C. Lewis.

Chicago, Gulf Point & Mobile Point.—The following are the incorporators: Thaddeus McNulty, D. Williams, Henry McEwen, J. J. Clements, William J. Lee and Thomas W. McDonald, Mobile, Ala.; C. S. Bushnell, New York; J. M. Dawson, Cincinnati; J. K. Lee, St. Louis, and E. T. Warner, Lexington, Ky.

Cincinnati, Hamilton & Indianapolis.—At the annual meeting of the road held at Hamilton, O., the stockholders re-elected all the old board of directors except Mr. Joyce, of Marysville, O., who was succeeded by John Howard Taylor, of New York.

East Tennessee, Virginia & Georgia.—W. A. C. Ewen has been appointed Comptroller of the East Tennessee, Virginia & Georgia Railway and leased and operated lines, and of the Memphis & Charleston, with headquarters at No. 80 Broadway, New York City. He will have immediate charge of the treasury and accounting departments.

Farmington & Kennebec.—The company organized at Gardiner, Me., June 22, when the following officers were elected: President, J. F. Hill, Augusta, Me.; Treasurer, A. M. Spear, Gardiner; Directors, F.E. Timberlake, Phillips; M. V. B. Chase, J. F. Hall, Augusta; A. M. Spear and Weston Lewis, Gardiner, and H. F. Shaw, Mt. Vernon, Me.

Louisville & Nashville.—George B. Horner, who has served as city ticket agent at Cincinnati for several years, has been appointed Assistant General Passenger Agent, with headquarters in the same city, to fill the place of S. S. Parker, deceased.

Lynchburg & Durham.—The new officers of this road were given last week. The new directors elected at the annual meeting are: George W. Watts, Durham, N. C.; L. A. Carr, J. A. Long, H. A. Edmundson, James Stebbins, Halifax, N. C.; R. L. Miller, J. B. Winfree, S. H. Nowlan, R. H. T. Adams, Max Guggenheimer, Jr., E. W. Clark, Lynchburg, Va.; John B. Lenny, Prof. E. J. Houston, James Butterworth, Philadelphia, and John Hickson, Campbell Co., N. C.

Macon Construction Co.—W. B. Sparks, of Macon, Ga., has been elected President of this company. The Directors elected the following Finance Committee: H. J. Lamar, Sr., W. B. Strange, A. Bacher, A. Snyder and W. B. Sparks.

Norfolk & Western.—Walter L. Rohr, of Roanoke, has been appointed General Western Agent of the road, with headquarters at Louisville, Ky.

Northern Pacific.—Charles Harlowe, Assistant Engineer of the Tacoma, Olympia & Gray's Harbor road, has resigned, and J. C. Patterson has been appointed in his place to have charge of the construction of the road from Centralia to Ocosta, Wash.

Parry Sound.—The following officers were elected at the recent annual meeting at Parry Sound, Ont.: President, P. McCurry; Secretary, J. M. Ansley, and Treasurer, John McClelland, all of Parry Sound. Chief Engineer, S. R. Poulin, Emsdale, Ont.

Pittsburg, Shenango & Lake Erie.—Col. A. B. Dick, Meadville, Pa., was re-elected President at a meeting at Erie, Pa., June 19. A. C. Hindekoper was elected Vice-President and J. T. Blair, Greenville, Pa., General Manager.

Portland, Nehalem & Astoria.—The following directors have been elected: J. D. Merryman, Senator Tongue, Dr. Bailey and President Schute, of Hillsboro, Or.; T. F. Osborn, C. H. Dodd, John McCraken, J. H. Smith, Portland, and Thomas Braden, Vernonia.

Rock Island & Peoria.—At the annual meeting at Rock Island, Ill., June 20, the following officers were re-elected: President, R. R. Cable; Vice-President, A. Kimball, and Secretary and Treasurer H. B. Sudlow.

St. Louis Southwestern.—E. B. Ashcraft has been appointed General Agent, with headquarters at No. 5 Monroe street, Memphis, Tenn., vice L. D. Knowles, resigned.

Savannah, Americus & Montgomery.—This company having leased the Albany, Florida & Northern from Albany to Cordele, Ga., the authority of W. E. Hawkins, Assistant to the President, W. N. Marshall, General Superintendent, S. C. Cooper, Treasurer, and E. S. Goodman, General Freight and Passenger Agent of this company, has been extended over that road.

Seattle, Lake Shore & Eastern.—The stockholders of the company, at their annual meeting, reduced the number of trustees from 13 to 5 and re-elected the following members of the old board: Gen. T. M. Logan and Gen. J. H. Bryant, New York; A. S. Dunham, H. R. Talcott and John Craig, Seattle, Wash. There were 25,701 of the 31,730 shares of stock represented. The following officers were elected by the trustees: President and General Manager, A. S. Dunham; Secretary and Cashier, L. J. Heacock; Auditor, John Craig; Assistant Treasurer and Secretary, H. D. Williams; Chief Engineer, Harry R. Talcott.

Union Pacific.—J. C. O'Melveny, Engineer of the Idaho Division with headquarters at Pocatelio, Idaho, has been appointed Engineer of the Utah Division in addition, succeeding G. H. Dickinson, resigned.

West Virginia & Pittsburgh.—H. A. Rebrook, of Clarksburg, W. Va., has been appointed Roadmaster of the section between Weston and Sutton, W. Va.

RAILROAD CONSTRUCTION, Incorporations, Surveys, Etc.

Bridgeport & Decatur.—The contract for the grading and tracklaying between Bridgeport and Decatur, Tex., will be let about July 15. The survey for the relocation of the line now in progress will be completed by July 1. The road is to extend from Decatur, on the Union Pacific,

Denver & Gulf, southwest to coal mines at Bridgeport, in the Texas Panhandle, and will be about 12 miles long. The construction work will be easy and the maximum grade will not exceed one per cent. The maximum curves are four degrees.

Burlington & Missouri River.—General Manager Holdredge, states this company, has decided that no additional construction work will be undertaken this year. The short branch to Hot Springs, in South Dakota, will be completed this month, and in July a few miles will be laid to the head of Donkey Creek, west of Merono, Wyo., upon the grade that was constructed last year.

Caldwell.—The tracklaying on this road has been completed this month and the line will probably be opened for regular service next week. It extends from a connection with the New York & Greenwood Lake road at Great Notch southwest to Caldwell, N. J., about five miles west of Montclair. The line is 4⅕ miles long, and has been built by C. W. Leavitt & Co., of No. 169 Broadway, New York City.

Charleston, Clendenin & Sutton.—A temporary organization was completed at a meeting at Charleston, W. Va., last week. The company will be formally organized at a meeting to be held in Charleston, July 2. About $70,000 of the capital stock has been subscribed by merchants of the city. It is expected that by the time these subscriptions are collected the directors will have made arrangements for building the line. The road is to be built along the Elk River Valley from Charleston to Sutton, Braxton County, there to connect with the West Virginia & Pittsburgh. It will pass through a coal and timber land not now accessible except by the Elk River, which is not navigable, and which the government engineers have refused to recommend to Congress for improvement.

Chicago, Gulf & Mobile Point.—The articles of incorporation for this company were filed in Alabama last week. The terminal points of the proposed road will be at Mobile Point, in the vicinity of Fort Morgan, Baldwin County, and at the intersection of the Mobile & Ohio and Mobile & Birmingham roads, north of the city of Mobile and in the county of Mobile. The capital stock of the proposed company is fixed at $4,000,000.

Cincinnati & Kentucky Southern.—H. D. Emerson, W. J. Perkins, Edward Ritchie and others have chartered this company, and intend to build a road between Yosemite, Ky., and King's Mountain. The capital stock is $200,000.

Cleveland, Akron & Columbus.—It was recently reported that the company would extend its belt line at Akron, O., a distance of seven miles. This report arose from a recent purchase of land in South Akron for yard room, and is untrue. The line at Akron, which may be extended to form a belt line, is at present simply a spur track running through the manufacturing suburbs of Akron, and also running through the land purchased by the company for additional yard room. The intention is to connect the track through the new yard grounds, making the line about one and a half miles long. The company will probably build two and a half miles of siding this year on the new ground purchased.

Danville & East Tennessee.—The contract for building the first 27 miles of the road east of Bristol, Tenn., to Damascus, Va., has been re-awarded, Edwards & Co. having failed to carry out the contract. The new contractors are J. B. Sullivan and T. R. Moorman, of Lynchburg, Va.

Deer Creek & Susquehanna.—The company at a recent meeting decided, it is stated, to annul the existing contract with John H. Miller for building its road, and to award a new contract to the Baltimore Forwarding Co. for completing the line. The company also, it is said, authorized the increase of the capital stock by $46,000 and the issue of $2,000,000 of bonds.

Delaware & Hudson Canal Co.—The double-tracking has been completed to Whitehall, N. Y., which gives the company about 40 miles of second track on its northern division. The section just completed is the line between Fort Edwards and Whitehall, 23 miles in length.

Delaware Terminal.—The charter members of this company, which was chartered by the recent session of the Delaware Legislature, met at Dover, June 23, to form a preliminary organization, by electing W. L. Sirman Chairman and John D. Hawkins Secretary. The road has a charter to extend from the Iron Pier at Lewes to any point within the state. It is rumored that the road will be built from Lewes to Clayton, and there connect with the Central of New Jersey which crosses the Delaware at Bombay Hook. Under the terms of the charter stock worth $200,000 must be subscribed for and 15 per cent. paid in before operations can be begun.

Duluth, Red Lake Falls & Northern.—A preliminary survey has just been completed from St. Thomas, N. D., to Duluth. The line starts from St. Thomas, N. D., and extends southeast through Red Lake Falls, Minn., thence east, crossing the Mississippi River, twice to the Mesaba iron range (which is in town 58, range 18), thence southeast to Duluth. The total length is 340 miles. The maximum grade is 52.8 ft. per mile, and maximum curves 5 degrees. The average cost per mile will be about $12,000. The line strikes the Mesaba range, opening up some of the rich iron mines in the state, and further west in northern Minnesota it reaches some excellent pine lands. After leaving the pine country, going west, the route is through a fertile wheat country in northwest Minnesota, the Red River Valley. The surveys have been made by L. I. Jonte, of Duluth.

Interstate Land & Construction Co.—This company has been chartered in Florida by J. C. Davis, W. P. Denham and George Lewis, of Tallahassee. The company will build railroads, and has a capital of $1,000,000.

Lewiston, Augusta & Camden.—This company was organized at Augusta, Me., this week and the charter will soon be filed. The capital stock is $500,000. It is proposed to begin the construction of the road at once.

Morristown & Cumberland Gap.—Tracklaying on this road was resumed at Morristown, Tenn., June 17. The road has been graded from the connection with the East Tennessee, Virginia & Georgia at Morristown, Tenn., to Floyds, on the Louisville & Nashville, a distance of 48 miles. Some of the track near Morristown was laid early in the spring, but the work has been suspended for several months.

New Jersey Extension.—It is reported that articles of incorporation will be filed in New York State for this road in a few days. The road is to extend from Newark, N. J., to the Poughkeepsie Bridge by way of Lodi Junction and Hillsdale, Bergen County, N. J., and Tappan, Rockland County, N. Y., via the West Shore road. Surveyors are now at work between Newark and Tappan.

Newton & Helvetia.—A charter was issued last week in West Virginia to this company to build a short line of road from Buckhannon, Upshur County, to the Left Hand Fork of Buckhannon River, in the same county. The capital stock is $50,000. The incorporators are A. G. Griffin, J. E. Craddock and others, of Buckhannon.

New Roads.—The survey of the railroad from Florence to the Gulf of Mexico has progressed from the Tennessee River, opposite Florence, to the fork of the two branches of the Warrior River, near Toadvine, in the southwest part of Jefferson County, the route running by way of Jasper. This is the survey provided for by the recent act of the state legislature. The engineering party is in charge of John A. Milner.

It is reported that a road will be built from Wigginsville to Flint River, Ga.

The contract has been let to R. A. Chaffee to build a road from Aiken to the Aiken Firebrick Works, in South Carolina. The distance will be 1⅕ miles.

King & Dickinson, of Tacoma, have been awarded the contract for building an extension of three miles of track and terminal improvements, including coal bunkers, for the Fidalgo Belt Line at Anacortes, Wash. The new track will extend from the present terminus, a mile beyond the Northern Pacific station, to Burrows Bay, where the coal bunkers will be built.

A narrow-gauge road is being built at Cloverdale, Va., by the Crozer Iron Co., of Roanoke, Va.

A company has, it is reported, applied for a charter to build a road from the Tennessee River via Sequachee, Tenn., thence up Little Sequachee Cove.

Norfolk & Western.—Work on the Ohio & West Virginia extension in the neighborhood of Twelve Pole River, in West Virginia, has been delayed somewhat by the washing out of a dam and the carrying off of the false work of the bridge in course of erection near Wayne C. H. Tracklaying will be resumed at that point as soon as the bridge is completed, and work is now going on on the opposite side of the river, and above 35 miles of the tracklaying has been completed on the extension on two sections. Between Kenova and Wayne 22 miles has been laid since January, and north of Elkhorn, the southern terminus of the line, 13 miles of track has been laid.

Northampton & Hertford.—Occoneechee Township, in Northampton County, N. C., voted recently on the proposed subscription of $30,000 to the road from Garysburg to Jackson. The road lost the subscription, there being 249 votes against it to 239 in its favor.

Northern Pacific.—Griggs & Huestis, of Tacoma, Wash., who are building the second track between Tacoma and Puyallup, Wash., now have about 130 men on the work, but are to increase their force immediately to 300 men. The grading for the second track has been completed for about half a mile. It is easy work, but there is a long haul and trainwork on account of the marshy ground. The new track will have a maximum grade of 12 ft. per mile and a maximum curvature of seven degrees.

Orange & Keysville.—The Chancery Court of Richmond, Va., has refused an application to appoint a receiver for this road, which is partly built from Keysville to Gordonsville, Va.

Oregonian.—The extension of the Woodburn and Coburg line has been completed to Springfield, Or., a distance of 13 miles, and trains are now running regularly to that point.

Paris, Choctaw & Little Rock.—It is reported that a number of capitalists, represented by C. G. Woodbridge, have about concluded negotiations for building this road in Texas from Paris to the Red River.

Parry Sound Colonization.—The contractors expect to complete the grading and tracklaying on the first 30 miles of this road from Parry Sound, Ont., early next November. At present 10 miles of track has been laid east of Parry Sound, and the second 10 miles, which is now about one-third graded, will be finished early in September. The work is easy. The maximum grade is 50 ft. per mile, and the maximum curve, five degrees, is only used at one place. William G. Reid, of 30 St. John street, Montreal, Que., has the contract for the line between Parry Sound and Emsdale, and has let the subcontract to Elliott, Fitzpatrick & Co., of Emsdale, Ont. The line now under construction is to extend from Parry Sound, on Georgian Bay northwest to Emsdale, on the Grand Trunk, a distance of 48 miles. When the road is completed it will be absorbed by the Ottawa & Parry Sound line, a continuation of the Canada Atlantic projected to extend from near Ottawa northwest to Emsdale and Parry Sound.

Pennsylvania.—That portion of the Trenton Cut-off between Morrisville and Earnest, Pa., a station about two miles from Norristown, was opened for passenger travel June 22, with a regular service. The cut-off has not been built for local passenger traffic, and passes through no towns of any consequence, but six stations have been located along the line. These are given below, with their distances from Morrisville: Dunlap, 5.8 miles; Attleboro, 8.8 miles; Roxton, 12.4 miles; Drisher, 22.5 miles; St. Thomas, 25.4 miles; Whitemarsh Junction, 30.3 miles; Earnest, 31.4 miles. The road has been very carefuly constructed. The grades are very light, the curves easy, and grade crossings of highways have been almost entirely avoided by carrying the roads either above or below the tracks. The Reading Railroad is crossed overhead at three places, the North Penn branch near Fort Washington, the Northeast Pennsylvania near Hatboro, and the Bound Brook division near Woodbourne. These briuges, as well as those over the Neshaminy and Wissahickon creeks and other streams, are all of the most substantial construction. From Earnest station to below Norristown, where connection is made with the Schuylkill Valley branch of the Pennsylvania, some work yet remains to be done, and from Norristown to Glen Loch, up through the Chester Valley, there is still so much to be done that it will be several months before the cut-off is finished throughout its entire length. Work on this portion is being pushed as rapidly as possible. At present all the coal and freight coming down the Schuylkill Valley Division for New York and the East will be forwarded over the Trenton branch, and the tonnage will be increased, once the branch is open from Frazer, to the relief of the yard at Fifty-second street, Philadelphia.

Perry County.—The extension which is now being located from the terminus of the road at New Bloomfield southwest to Loysville, Pa., will be completed in about three months. The extension is to be built by the company's own forces, as was the main line, the work not being let to contractors. The maximum grade on the extension will be 25 ft. per mile. The new line will reach a part of Perry County that is thickly settled, and will give a heavy freight traffic in iron ore, building stone, and lumber and grain.

Philadelphia & Reading.—This company announces that the Philadelphia & Seashore road, connecting with the Reading's Atlantic City line at Winslow Junction, N. J., has been completed to Sea Isle City, N. J., and is now open for freight traffic to that point. The Reading will furnish the passenger equipment, and probably operate the road under a long lease when the road is ready for passenger traffic.

Portland, Nehalem & Astoria.—This company was incorporated in Oregon last week. It proposed to take over the completed road of the Astoria & South Coast road between Clatsop Junction and Seaside and Hillsboro and to extend it from the latter town to coal fields at the Nehalem River, near Vernonia, in Columbia County, Or., a distance of about 26 miles. When last March the English syndicate declined to close its option on the road without a guarantee from the town of Astoria, Wash., to pay the interest of the bonds for three years the Pacific Construction Co. transferred its contract and interest to the South Coast Construction Co. That company has since secured absolute control of the line to Hillsboro, Or., 87 miles, and proposes to change the route down the Lewis and Clarke River to Young's Bay. This will shorten the route eight miles between Astoria and Hillsboro. The capital stock is placed at $1,000,000. The termini of the lines are fixed at Portland, Hillsboro or Forest Grove, Astoria and Clatsop Beach (Seaside) in Clatsop County.

Portland & Rochester.—The extension of this line through the city of Portland from the former independent station to the new Union station was opened for traffic June 17. The extension is about 3,700 ft. long, and extends the line from Green street to Portland street. The cost of constructing the line has amounted to about $85,000. Several overhead bridges across the streets were built and other expensive work was necessary.

Port Townsend Southern.—The track has been laid on the extension from Lake Hookers south to Quilcene, Wash., eight miles, and trains have been run over it, but there is still some surfacing and ballasting to be done on the line.

Rio Grande Western.—H. T. Reynolds, of Springfield, Utah, who is building the narrow-gauge Sevier Valley branch, has been awarded the contract for grading 44 miles of the new branch to the Tintic mines, south of Great Salt Lake. This road is to leave the main line at Springville, and extend south through Goshen to Tintic, Utah.

St. Louis, Grand Tower & Southern.—The contracts for grading the 65 miles of this road along the east bank of the Mississippi River from East St. Louis south to Grand Tower, Ill., were let last week. The right of way has been secured and the locating survey has been nearly completed. It is now in progress between the Okaw River, near Chester, to Grand Tower, the southern terminus, a distance of 20 miles. The contractors are to begin work immediately and are to have 20 miles of the road completed early in September. The contract for the grading has been awarded to the following firms: Nier, Shafer & Allison for the first six miles to Cahokia; Benjamin Johnston for the next nine miles; E. Waldrons for the next seven miles to Harrisonville; William Strang, eight miles to Ivy Landing; Bethuene & Co., 10 miles to the Okaw River; L. N. Chase, 11 miles to Chester; Dwight Eaton for four miles, and Johnston & Faught for the last 14 miles to Grand Tower. The contract for the bridgework will be let in a few days. M. C. Brown, of East St. Louis, is General Manager, and Clinton F. Stephens, of St. Louis, is Chief Engineer.

San Antonio & Aransas Pass.—Bids were opened June 19 for the construction of the road from Lexington to Lott, Tex., a distance of about 65 miles. McFlynn & Kennedy offered to do the work for $300,000, to be paid in receiver's certificates, and will be awarded the contract. The building of this road will close up the gap and complete what is known as the Waco extension. It will open a rich cotton-producing country. Work will begin immediately, and will be pushed to completion before the first of the cotton crop is marketed.

South Bound.—All the piers for the iron bridge across the Savannah River about 10 miles from Savannah have been completed except in one instance where a tree trunk found below the river bed has obstructed the work. Part of the superstructure is also completed, including the draw span. The long trestle on the east side of the Savannah River through the swamps in Beaufort County is being built. As soon as this trestle is completed the road will be opened between the Savannah River and Graham's, on the South Carolina road. It is thought that trains will be running to this point about the middle of July.

South Brunswick, Atlanta & Northwestern.—The company will petition the next session of the Georgia Legislature for a special charter. It is the intention of the company to build a road from Brunswick, northwest, to Fort Valley, Ga., on the Atlanta & Florida.

South Chester.—A charter was granted at the State Department at Harrisburg, June 23, to this company. It is to build a road four miles long, extending from Sampkin Station, on the Philadelphia, Wilmington & Baltimore road, to a point on the dividing line between Pennsylvania and Delaware, south of Marcus Hook. The capital stock is $250,000. John P. Green, of Philadelphia, is President.

Spartanburg, Glendale & Clifton.—This company has commenced the building of the road at Spartanburg, S. C. The construction is in charge of M. W. Floyd.

Staunton & West Augusta.—E. C. Vincent, Chief Engineer of this road, is making a preliminary examination of the country with a view of constructing a line from Staunton, Va., through Shenandoah, Cheat, and other intervening mountains, to intersect the West Virginia, Central & Pittsburgh, near Elkins, W. Va. This route as projected will run via Churchville, Jennings Gap, Calf Pasture Divide, North River Gap, Palo Alto, Doe Hill, Crab Bottom, North Fork, Osceola and Glady. He has so far secured a route without tunnels, with a maximum grade of 80 ft. per mile, to the waters of Glady Fork, the base of Cheat Mountain. There are no difficulties apprehended on this mountain. Considering that this route strikes the general trend of these mountains at right angles the grade of the road is noticeably low and easy. The cost of construction will be much less than usually allowed for mountain rail-

roads. Owing to the peculiar geological formation the cost of maintenance of roadway will be comparatively small. The engineers find old, abandoned highways where work had been suspended 30 to 50 years, with comparatively as good road-bed as when last used. One of the officers writes that iron, coal and timber along this route is met in large quantities, and of fine quality. There is fifty to one hundred thousand feet of lumber to the acre. The elevation is two to four thousand feet above the sea level.

Temiscouata.—The extension of the St. Francis branch, which follows the St. John River from Clairs to Connors, N. B., is now about graded for one-third of the distance. The contractors are McDonald & Boswell and Malcolm & Ross, of Reviere du Loup, Que. They have about 400 men at work on the 12 miles now being built. The maximum grade is 1½ per cent. and the maximum curvature seven degrees. The line has been located from Clairs, which is on the Canadian side of the St. John River and opposite Fort Kent, Me., to the terminus at Connors.

Western Carolina.—At a meeting held at Westminster, S. C., the organization of the company was completed. E. R. Muncy was elected President, W. J. Kirk General Manager and Chief Engineer and J. A. Brock Treasurer. The proposed line of the road is from some point on the Atlantic coast in South Carolina, via Westminster, to Anderson.

West Virginia & Pittsburgh.—The following are the contractors working on the 44 miles of extensions of this road now under construction: Thomas J. Steers & Co., F. H. Blodgett & Co., Joseph Fuccy, M. H. Chapman, P. Dougher and P. J. Millett. Two lines are now being built and will be graded the present season: The Gauley extension from Shaversville, a few miles above Sutton, southeast, to Williams River, a distance of 35 miles, and the extension from Newlon to Florence, W. Va., a distance of nine miles.

GENERAL RAILROAD NEWS.

Chicago, St. Louis & Peoria.—A mortgage given by this company and the St. Louis & Northern Railway Co. to the Metropolitan Trust Company, of New York, was filed last Saturday in Sangamon County, Ill. It is for $2,744,000, and the proceeds are to cancel the outstanding mortgages of the two companies, which have been consolidated.

Cincinnati & Westwood.—The gauge of this road is to be changed from 3 ft. to standard between Cincinnati and Robb's Station, O., six miles. A special meeting is to be held at Cincinnati to vote on a proposed increase of the capital stock to $200,000, and an issue of first-mortgage six per cent. bonds to the amount of $100,000. The proceeds of stock and bonds issued are to redeem the bonds and interest coupons of the company, pay its unfunded debts, increase its rolling stock and make improvements, including the change of gauge.

Elgin, Joliet & Eastern.—The Central Trust Company, of New York City, is having filed in the county courts in Indiana a mortgage for $5,479,000 to secure bonds of that amount issued to the Trust Company.

Georgia Pacific.—The stockholders, at a meeting held at Birmingham, Ala., last week, voted to issue a mortgage to secure equipment bonds to the amount of $1,500,000. The purpose of this mortgage is to retire outstanding equipment certificates and for the purchase of additional rolling stock. It is the intention to expend considerable in this direction during the next year.

Indianapolis, Decatur & Western.—In the Superior Court at Indianapolis, June 23, an agreed decree of foreclosure was entered against the road to satisfy a mortgage of $1,500,000. The reorganized road will be called the Indianapolis, Decatur & Quincy.

Kansas City, Wyandotte & Northwestern.—In the United States Circuit Court at Leavenworth, Kan., June 18, the decree of foreclosure and sale of the road was recorded. The sale, which will take place next December in Topeka, is to satisfy a claim of $3,750,000, exclusive of interest on the unpaid coupons of the Farmers' Loan & Trust Co., of New York. Hiram P. Dillon, of Topeka, has been appointed Master Commissioner.

Maine Central.—A circular recently issued by the directors states that the corporation has concluded to issue its capital stock of the par value of $900,000 for the purpose of providing for the cost of double-tracking a portion of its road, for equipping new road acquired last year, and for other improvements. The company offers to stockholders the right to subscribe for one share of the new stock at par for each four shares of the capital stock standing in their name. The stock will be delivered Sept. 15, 1891, and will be entitled to dividends declared after that date.

New York & New England.—General Manager Charles Howard said in a recent interview that about $200,000 would be required this year for construction purposes. The directors at their last meeting subscribed for 6,000 shares of the preferred stock in the treasury at par. "We have spent on construction account since Oct. 1, 1889, over $600,000, and we were carrying against this in time loans $545,000, with preferred stock as collateral. Our interest on this was 5½@6 per cent., and was put into our fixed charges, so that the sale of the preferred stock to close the account will increase our charges $6,000 to $9,000 per annum. The statement that we had a floating debt of $917,000, published last week, is in error. These figures are the aggregate of our notes payable and $460,000 of six or seven years' equipment notes. We do not need the new money immediately, and therefore subscriptions to the preferred stock are payable 50 per cent. June 25, and the balance by Sept. 1, and will take up our time loans as they mature."

Northern Pacific.—When the Canadian Pacific began to build its Mission branch to the international boundary line it was expected that its cars would run over the Seattle, Lake Shore & Eastern to Seattle. The latter road is now controlled by the Northern Pacific, and the Canadian Pacific reaches Seattle over the Bellingham Bay & British Columbia road to New Whatcom, on Puget Sound, and by boat the balance of the distance. General Manager Mellen denies that the Northern Pacific has made this arrangement necessary by refusing to allow trackage rights over the Seattle, Lake Shore & Eastern. He says: "We had arranged a contract by which the Canadian Pacific was allowed to run its cars or trains through to any point of the Lake Shore road, and the Canadian Pacific has accepted with the exception of one point. It asks us to allow a differential on through business. We are willing to agree to equal rates. If the Canadian Pacific insists on the provision, and the agreement is not concluded, we shall arrange our schedule so that our trains will connect as nearly as possible with it at the boundary."

Pennsylvania.—The following is a statement of the business of all lines of the company. All lines east of Pittsburgh and Erie for May, 1891, as compared with the same month in 1890, show a decrease in gross earnings of $317,781, a decrease in expenses of $153,216 and a decrease of net earnings of $164,565. The five months of 1891, as compared with the same period of 1890, show a decrease in gross earnings of $751,751, a decrease in expenses of $483,115 and a decrease in net earnings of $268,636. All lines west of Pittsburgh and Erie for May, 1891, as compared with the same month in 1890, show a decrease in gross earnings of $311,854, a decrease in expenses of $320,196, an increase in the net earnings of $8,342. The five months of 1891, as compared with the same period of 1890, show a decrease in gross earnings of $1,258,945, a decrease in expenses of $1,293,489 and an increase in net earnings of $34,544.

Philadelphia & Reading.—Judge Acheson filed an opinion in the United States Circuit Court in Philadelphia last week overruling the plea made for the company in the suit of John Lornie, for the payment of interest on the third-preference income bonds. The complaint was that interest should have been paid upon the bonds on the ground that it was earned. Under the decree made the plea was overruled without costs, and it was ordered that the railroad and coal and iron companies answer the bill of complaint before next month.

Pittsburg, Cincinnati, Chicago & St. Louis.—The statement just issued of the business of the company for May, 1891, as compared with the same month in 1890, shows the following: Decrease in gross earnings, $131,871; decrease in expenses, $109,476; decrease in net earnings, $21,894. The five months of 1891, as compared with the same period in 1890, show a decrease in gross earnings of $530,727, a decrease in expenses of $477,495 and a decrease in net earnings of $53,232.

Poughkeepsie Bridge Co.—The Bondholders' Committee announces that holders of $3,300,000 out of the $5,000,000 of bonds have accepted the proposition to deposit two years' coupons with the committee, receiving therefor interest bearing scrip. The funds necessary to connect the bridge system with the New York & New England road have been provided, and work will be begun soon by the Dutchess County road. The committee expects that the large increase in traffic that will follow the completion of this connection will be sufficient to warrant a readjustment of the bridge company's indebtedness at a lower rate of interest, and so avert a foreclosure. The net earnings for the first three months of the year show an increase of 50 per cent. over last year, while the number of cars passing over the bridge in May was double that for May of last year.

Rutland.—The stockholders of the road at the special meeting June 18 voted to execute a consolidated 4½ per cent. mortgage for $3,500,000 to the United States Trust Co., of New York, as trustee. Three millions of the bonds will be held by the trust company to take up existing mortgages as they mature, and $500,000 will be used in making permanent improvements, building bridges and stations, laying 72-lb. rails and buying rolling stock.

San Antonia & Aransas Pass.—Judge King, in the District Court at San Antonia, Tex., has overruled the exceptions filed by the New York bondholders of the road to the ruling of the Master in Chancery, who had ruled that the local creditors of the road—the men who built it etc.—took precedence over the bondholders in the disbursement of the receipts. Judge King sustained the master. Notice of appeal was given.

Union Pacific.—President Dillon, in a recent interview at Tacoma, said: "When it was decided to build the extension from Portland there had been no provision made for the work, and so, when the depression began to be felt there was no more money, and we stopped. It is about impossible to float any bonds here or in Europe. Yes, it is true that the Great Northern is allied with Union Pacific in building the extension. There is a contract by which they are entitled to an interest in the road. There has been something like $2,000,000 spent on the line. Grading is about half completed, and the question of abandoning the work has never been considered. I cannot say when it will be resumed, but the extension to Tacoma will be built." After returning to New York President Dillon spoke about as follows: "I have been over 8,000 miles of the Union Pacific main line and all its branches. Each division was inspected separately and carefully, and we examined the condition of the different shops along the lines. I found the track in good condition. Our main idea now is to economize at every point, so as to keep down operating expenses, because the business of the country at this time does not warrant as large expenditures as in previous years, and will not until the fall crops come in. As to the country I never saw it look better. There has been plenty of rain, and the crops are good throughout the West."

TRAFFIC.

Chicago Traffic Matters.

CHICAGO, June 24, 1891.

There is no material change in the traffic situation here this week. Affairs are by no means in the critical condition some of the press dispatches sent out would indicate, nor is there any cause for apprehension that there is to be an immediate war in passenger rates.

The Central Traffic Association announce that all articles sent to the World's Columbian Exposition should be billed to the Exposition grounds, via the Illinois Central, at Chicago junctions, at full tariff rates. Bills of lading must show precise routes in detail to facilitate return of same. Horses and other valuable and fancy animals intended for exhibition will be charged tariff rates in both directions, one attendant to be transported free in charge of each consignment of one car load or less. Construction material is to be treated as commercial traffic and will be charged at full tariff rates.

Grain freight rates by lake, which have for some time been at the low basis of one cent a bushel for wheat from Chicago to Buffalo, were on Monday advanced to 1,25 cents. This comes about through the settlement of the ore handlers' strike at Lake Erie ports, which caused a brisk demand for boats to take iron ore from Escanaba, and it is said that nearly the entire fleet now unloading coal at Chicago and Milwaukee will be turned into the ore trade at once.

The Board of Commissioners of the Western Traffic Association have rendered decisions in the following matters: The application of the Chicago, Burlington & Northern to reduce rate on potatoes, c. l., from St. Paul to Chicago is denied, the board not finding valid reason for interfering with the present adjustment. The Atchison is ordered to withdraw on or before June 30 a differential tariff issued in connection with the Mallory Steamship Line via Galveston from Atlantic seaboard points to Kansas points in contravention of and without the consent of the Association. The board have ordered an advance in round-trip tourist rates between Missouri River common points and Utah common points from $47.50 to $55, effective July 14.

The lines interested in the business from New Orleans and Gulf ports to the West and Northwest and the Western Freight Association have come to an understanding, and hereafter no changes in tariffs will be made without the concurrence of the Western Freight Association. Consequently the Western Freight Association has suspended its order cancelling all tariffs on this business June 30.

The appeal of the Illinois Central from the decision of Chairman Finley imposing a fine of $100 for failing to advance St. Louis-Chicago rates has been heard by the arbitrators, but no decision has as yet been rendered.

Traffic Notes.

Mr. C. E. Fulton has been elected Commissioner of the Passenger Department of the Chicago & Ohio River Association.

The first excursion on the Manitou & Pike's Peak Railroad is announced for June 30. The number of passengers is limited to 100 and the round trip fare from Denver is $8.

The Railroad Commissioners of Texas announce that they will begin on July 6 the work of establishing freight classifications for all the roads of the state; and the companies are notified that rates which were in force June 10 can now be changed only by approval of the Commission.

The members of the Interstate Commerce Commission, who have been hearing cases and making investigations in the West as far as the Pacific Coast have returned to Washington. Arguments of counsel on application for rehearing filed by defendants in the Delaware State Grange and Boston Fruit and Produce Exchange cases were heard by the Commission this week.

The Alton announces its intention of making a rate of $6 Chicago to St. Louis, a reduction of $1.50, and $10 Chicago to Kansas City, a reduction of $2.50, and these rates will probably be made effective within a few days. There is also a threatened reduction of $5 in the Denver rate. The lines are all moving slowly and do not seem disposed to inaugurate any serious rate war. The Alton is unquestionably profiting by the action of the Eastern lines, as it is carrying more passengers than usual and getting an immense amount of free advertising.

The Delaware, Lackawanna & Western, which has felt aggrieved ever since the Canadian Pacific began taking freight to the Northwest at very low rates from New York, concluded this week to establish a reduced tariff by way of boat across Lake Michigan and the Green Bay, Winona & St. Paul; on the basis of $1.20 first class New York to St. Paul; and such a tariff was issued on Monday in spite of the fact that the Trunk Line Association had refused to authorize the reduction; but on the refusal of the Trunk Line Executive Committee Tuesday to approve the tariff it was withdrawn.

Lake Traffic and Marine Affairs.

The east-bound freight traffic leaving Chicago for six weeks has been divided as follows:

Week ending.	Lake shipments, tons.	Rail shipments, tons.
May 9	81.821	57.506
May 16	73.696	48.963
May 23	64.541	40.108
May 29	75.801	34.480
June 4	87.233	42.607
June 11	88.616	44.140
Totals	471.708	267.804

That is, the lake carriers are doing nearly twice as much of the eastbound business out of Chicago, including local freights, as the railroads. There are no returns for the westward shipments. The ore shipments, however, are very small, not amounting to more than 22 per cent. of last season's shipments up to this time, and lumber freights are also slack. One steam "whaleback," with its consort, was at Kingston a few days since loaded with wheat for Liverpool, and another, the thirteenth of this style, has just been launched at West Superior for the same trade. They are built so as to have two inches clearance in the Welland Canal locks.

There has been an idea among Chicago shipping men for some time that Captain Marshall, the United States engineer officer at that port, did not understand the environments of the river traffic, and he, with the city officials, who have built some bridges which obstruct the waterway, were invited to ride on a large lake steamer carrying some 90,000 bushels of grain up the South branch and back again, so as to show them just what difficulties vessels have to cope with in the river. A great deal of interest was excited by the trip, but it is not yet known that more waterway will be afforded at the new bridges.

East-Bound Shipments.

The shipments of east-bound freight from Chicago by all the lines for the week ending June 20 amounted to 39,447 tons, against 44,140 tons during the preceding week, a decrease of 4,693 tons. The proportions carried by each road were:

	Wk. to June 20		Wk. to June 13	
	Tons.	P. c.	Tons.	P. c.
Michigan Central	4,087	10.4	4,418	10.1
Wabash	2,319	5.9	2,647	6.0
Lake Shore & Michigan South.	6.241	15.8	7,391	16.8
Pitts., Ft. Wayne & Chicago	5,127	13.0	7,117	16.1
Pitts., Cin., Chicago & St. L	5,070	12.8	5,873	13 3
Baltimore & Ohio	3,349	8.5	3,022	6.9
Chicago & Grand Trunk	3,325	8.4	3,611	8.2
New York, Chic. & St. Louis.	3,685	9.4	3,946	8.7
Chicago & Erie	6.214	15.8	6,085	13.8
Total	39,447	100.0	44,140	100.0

Of the above shipments 1,552 tons were flour, 10,926 tons grain, 2,040 tons millstuff, 3,772 tons cured meats 7,003 tons dressed beef, 1,243 tons hides and 6,330 tons lumber. The three Vanderbilt lines together carried 36.5 per cent., while the two Pennsylvania lines carried but 28.5 per cent.